NOV 10

ENGINEERING NEWS-RECORD

NOVEMBER 6, 1941

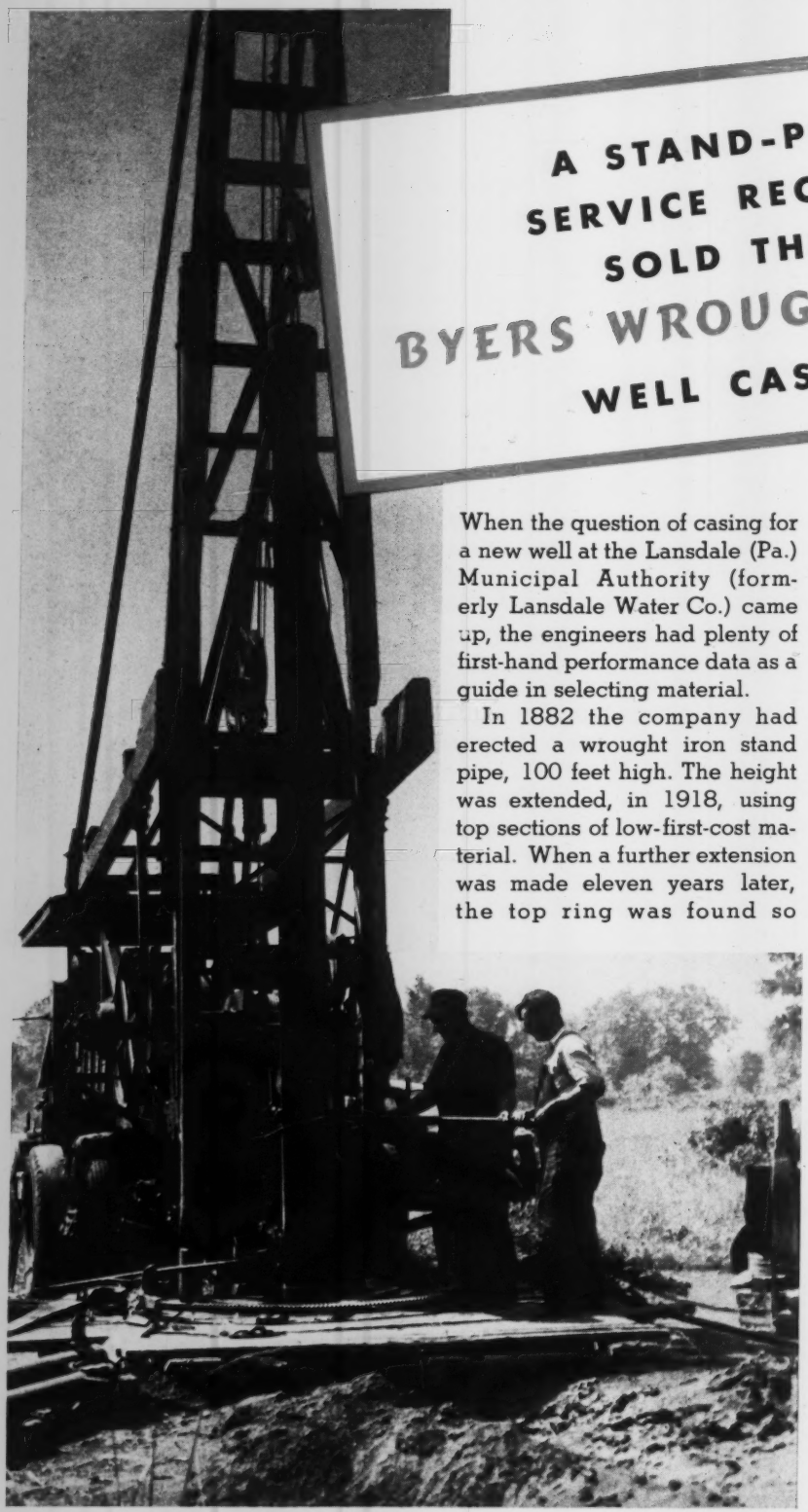
Paving two lanes on what ultimately will be the eastern end of Wilbur Cross Parkway in Connecticut

Designing to Save Steel

Post-Defense Highway Planning

Unique Steel Dome Building

Cut-Off at Hales Bar Dam



A STAND-PIPE SERVICE RECORD SOLD THIS BYERS WROUGHT IRON WELL CASING

When the question of casing for a new well at the Lansdale (Pa.) Municipal Authority (formerly Lansdale Water Co.) came up, the engineers had plenty of first-hand performance data as a guide in selecting material.

In 1882 the company had erected a wrought iron stand pipe, 100 feet high. The height was extended, in 1918, using top sections of low-first-cost material. When a further extension was made eleven years later, the top ring was found so badly corroded that it had to be completely replaced. Now almost 60 years old, the original wrought iron portion is still on the job.

In the past five years the municipality has had four wells drilled by Wm. Stothoff Co., Inc. In every well wrought iron casing was specified and used.

The long, trouble-free service rendered by wrought iron casings is a matter of engineering rec- The Rockford (Ill.) Wa- ment reported w- in "excellent condition ...ice, to permit enlargement of the well. A Maryland Water Company, in a locality where ordinary casings last only 10 to 12 years, has wrought iron casings installed in 1893 which are still in use. These examples are not at all unusual.

Our Engineering Service Department has records of water conditions, and of wrought iron's performance, in localities throughout the country. If you have some well-casing problem and want to solve it on the sound basis of actual field experience, just write.

A. M. Byers Co., Pittsburgh, Pa. Established 1864. Boston, New York, Philadelphia, Washington, Chicago, St. Louis, Houston, Seattle, San Francisco.

Corrosion costs you more than Wrought Iron

BYERS GENUINE WROUGHT IRON
TUBULAR AND HOT ROLLED PRODUCTS
STEEL TUBULAR PRODUCTS

ENGINEERING NEWS-RECORD

Devoted to Buildings, Sewers, Waterworks, Bridges, Highways, Streets, Dams, Foundations, Earthwork, Flood Control, Public Works, Irrigation, Canals, Railroads

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Vol. 127 NOVEMBER 6, 1941 No. 19

THIS WEEK

• A building of unique design was recently erected in Chicago, having a steel dome of 80-ft. span and 20-ft. rise built up of preformed dished sections of $\frac{3}{16}$-in. steel plate, butt-welded. The dome rests on a straight-side wall, 8 ft. high. Design and construction features are described in this issue.

• A new method for stopping the flow, now 1,700 cfs., under Hales Bar Dam involves calyx drilling of about 750 vertical overlapping holes, parallel to the upstream face of the dam. Filled with concrete, these holes form a cutoff wall extending to a maximum depth of 163 ft. Method and procedure are described in this issue.

• Can a concrete frame building be designed to use less steel? Will such design cost more? How much steel can be saved by a modified design? An analysis of several possibilities appears in this issue.

THINGS TO COME

• Concrete for the Navy drydock at the San Diego destroyer base is being delivered on 24-in. belt conveyors at rates up to 180 cu. yd. per hr. Delivery is made by direct drop anywhere in a 135x720-ft. area. The belt conveyor system will be described in the Nov. 20 issue.

• Studies made of soil pressures in open-cut sections of the Chicago subway have revealed interesting new information on movement of soil masses during excavation and loads on sheeting and bracing systems. These findings will be published in an early issue.

• Special problems involved in construction of an underground parking garage, 275x412 ft. and four stories deep in San Francisco to store 1,700 cars will be described in the Nov. 20 issue.

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Number of copies of this issue printed: 36,165

Call Ryerson for Reinforcing Bars

● There is a shortage of reinforcing bars, like all other steel products, which means that Defense orders have first call; however, we believe the situation will be easing a bit before long.

While we have not been able to take care of all requirements, it will probably pay you to check with us whenever you need reinforcing bars, wire mesh, accessories, etc. Deliveries are always co-ordinated with the progress of the job and bars are accurately cut, bent and tagged according to blue prints and specifications. Joseph T. Ryerson & Son, Inc. Plants at: Chicago, Milwaukee, St. Louis, Detroit, Buffalo, Cincinnati, Cleveland, Boston, Philadelphia, Jersey City.

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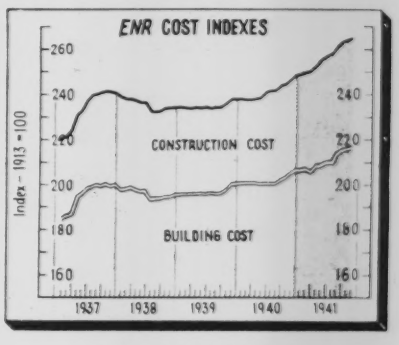
MONTHLY CONSTRUCTION BUSINESS SUMMARY

ENR CONSTRUCTION VOLUME AND NEW CAPITAL . . . . F H A MORTGAGES

(,000 omitted)	October 1940	October 1941	% Change	Ten Months 1940	Ten Months 1941	% Change
Total Construction	$702,842	$406,332	−42.0	$3,205,815	$5,250,210	+64.0
Private Construction	229,477	94,760	−59.0	960,978	1,061,698	+10.5
Public Construction	473,365	311,572	−34.0	2,244,837	4,188,512	+86.0
Federal	343,753	200,358	−42.0	1,048,893	3,111,447	+196.0
Total New Productive Capital	$685,906	$228,329	−67.0	$3,533,373	$6,089,206	+72.0
Private Investment	77,095	50,999	−34.0	651,275	707,098	+9.0
Federal (non-federal work)	77	177,330	.....	600,137	555,990	−8.0
Federal (federal work)	608,734	.....	.....	2,281,961	4,826,118	+112.0
FHA Mortgages Selected for Appraisal	$116,356	$113,983*	−2.0	$1,110,612	1,238,050*	+11.5

*Preliminary.



CONSTRUCTION COSTS . . . . WAGE RATES . . . . PRICES

	November 1940	November 1941	% Change	Change October to November 1940 Oct.	1940 Nov.	1940 %	Change October to November 1941 Oct.	1941 Nov.	1941 %
E N R Construction Cost Index, 1913 = 100	247.24	266.13	+7.6	245.02	247.24	+0.9	264.46	266.13	+0.6
E N R Building Cost Index, 1913 = 100	206.24	216.54	+5.0	204.02	206.24	+1.1	215.92	216.54	+0.3

ENR 20-CITIES' AVERAGE

Common Labor	$0.711	$0.768	+8.0	$0.711	$0.711	0	$0.761	$0.768	+0.9
Skilled Labor (av. 3 trades)	1.480	1.521	+2.8	1.480	1.480	0	1.516	1.521	+0.3
Bricklayers	1.568	1.614	+2.9	1.568	1.568	0	1.608	1.614	+0.4
Structural Ironworkers	1.542	1.588	+3.0	1.542	1.542	0	1.582	1.588	+0.4
Carpenters	1.330	1.362	+2.4	1.330	1.330	0	1.358	1.362	+0.3
Cement, per bbl.	$2.54	$2.54	0	$2.52	$2.54	+0.8	$2.52	$2.54	+0.8
Reinforcing steel, per cwt.	2.53	2.60	+2.8	2.53	2.53	0	2.59	2.60	+0.4
Struct. steel shapes, base	2.10	2.10	0	2.10	2.10	0	2.10	2.10	0
Sand, per ton	1.17	1.19	+1.7	1.16	1.17	+0.9	1.18	1.19	+0.8
Lumber, 2x4 Fir, per M ft.	37.76	46.86	+24.1	35.88	37.76	+5.2	46.47	46.86	+0.8
Lumber, 2x4 Pine, per M ft.	36.15	40.82	+12.9	33.96	36.15	+6.4	40.71	40.82	+0.3
Brick, common, per M	14.44	15.16	+5.0	14.43	14.44	+0.1	14.91	15.16	+1.7
Ready-mixed concrete, c.y.	6.94	7.11	+2.5	6.94	6.94	0	7.07	7.11	+0.6
Struct. clay tile, 3x12x12	74.79	76.94	+2.9	74.78	74.79	†	76.69	76.94	+0.3
Paving asphalt, cars, ton	14.21	15.10	+6.3	14.21	14.21	0	14.68	15.10	+2.9

†Less than .05 percent change.

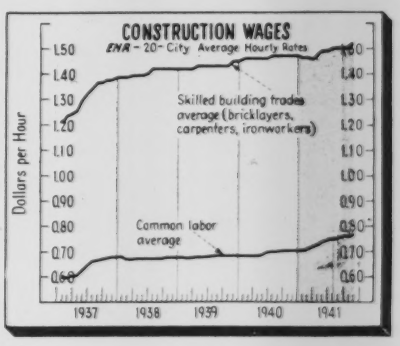
ENR INDEX NUMBERS

Base = 100	Construction Cost 1913	Construction Cost 1926	Building Cost 1913	Building Cost 1926	Volume '13	Volume '26
Nov., 1941	266.13	127.93	216.54	117.05		
Oct., 1941	264.46	127.13	215.92	116.72	263	115
Sept., 1941	263.12	126.48	214.58	116.00	419	184
Aug., 1941	260.41	125.18	212.45	114.84	434	190
July, 1941	258.18	124.11	210.22	113.64	635	278
June, 1941	256.79	123.44	209.41	113.20	492	216
May, 1941	255.55	122.84	209.24	113.11	275	121
April, 1941	252.40	121.33	208.60	112.76	322	141
Mar., 1941	250.71	120.52	207.88	112.37	386	169
Feb., 1941	250.50	120.42	208.42	112.67	374	164
Jan., 1941	249.69	120.03	207.94	112.46	402	176
Dec., 1940	249.12	119.75	208.19	112.54	344	151
Nov., 1940	247.24	118.85	206.24	111.49	331	145
Oct., 1940	245.02	117.78	204.02	110.29	490	215
1940 (Av.)	241.96	116.31	202.81	109.64	269	118
1939 (Av.)	235.51	113.21	197.44	106.73	211	92
1938 (Av.)	235.86	113.34	196.83	106.40	197	86
1937 (Av.)	234.71	112.66	196.15	106.07	172	75

MATERIAL SHIPMENTS . . . . BUILDING PERMITS

	October 1940	October 1941	% Change	Sept. 1941	% Change Sept.-Oct.
Lumber (% wk. seas. av., 1935–'39) N.L.M.A.	126.3	126.8	+0.4	126.3	+0.4
Steel (% operating capacity) A.I.S.I.	96.5	98.2	+1.8	94.4	+4.0

	September 1940	September 1941	% Change	Nine Months 1940	Nine Months 1941	% Change
Fabricated structural steel, tons, A.I.S.C.	142,834	199,200	+39.6	1,059,824	1,654,904	+56.3
Cement, thous. bbl., U.S.B. of M	14,741	18,284	+24.0	95,975	124,440	+29.8
Building Permits, Dun & Bradstreet (,000 omitted)	$118,942	$119,473	+0.4	$1,009,416	$1,152,449	+14.2



COST OF LIVING INDEXES

	September 1940	September 1941	% Change	Aug. 1941	% Change Aug.-Sept.
Cost of living index, N.I.C.B.	86.4	90.8	+5.1	89.4	+1.6
Rent (Housing) index, N.I.C.B.	87.0	88.9	+2.2	88.6	+0.3

ENGINEERING CONSTRUCTION CONTRACTS——ENGINEERING NEWS-RECORD——OCTOBER, 1941

Engineering News-Record *reports projects of the following minimum costs: —waterworks, excavation, drainage and irrigation,* $15,000; *other public works,* $25,000; *industrial buildings,* $40,000; *other buildings,* $150,000

Five Weeks—Thousands of Dollars (000 Omitted)

Public Works	New England	Middle Atlantic	South	Middle West	West of Mississippi	Far West	United States October 1941	United States Ten Months 1941	United States Ten Months 1940	Canada
Waterworks	181	1,196	192	1,150	4,087	1,197	8,003	68,650	62,938	425
Sewerage	109	2,497	616	1,108	1,160	564	6,054	74,657	77,821	353
Bridges, public	220	2,298	1,375	2,450	1,433	858	8,634	95,703	94,932	.....
Earthwork and waterways	107	1,100	1,035	3,126	3,453	9,158	17,979	230,615	205,329	135
Streets and roads	1,987	14,817	9,076	6,154	12,689	3,170	47,893	519,654	593,375	1,804
Buildings, public	2,474	40,928	43,512	12,085	16,706	39,665	155,370	2,461,873	821,782	3,645
Unclassified, public	5,767	28,886	6,996	1,454	6,654	17,882	67,639	737,360	388,660	11,874
Total public	**10,845**	**91,722**	**62,802**	**27,527**	**46,182**	**72,494**	**311,572**	**4,188,512**	**2,244,837**	**18,236**
Federal government (included in above classifications)	8,220	53,071	49,771	12,994	20,592	55,710	200,358	3,111,447	1,048,893	.....
Private										
Bridges, private	.....	40	.....	.....	.....	.....	40	5,762	10,670	.....
Buildings, industrial	1,815	17,523	893	21,666	6,803	5,105	53,805	453,967	492,084	5,115
Buildings, commercial	3,921	13,845	1,050	4,249	3,307	3,173	29,545	425,412	323,970	150
Unclassified, private	.....	504	3,677	897	4,132	2,160	11,370	176,557	134,254	57
Total private	**5,736**	**31,912**	**5,620**	**26,812**	**14,242**	**10,438**	**94,760**	**1,061,698**	**960,978**	**5,322**
Total Engineering Construction:										
October, 1941 (5 weeks)	**16,581**	**123,634**	**68,422**	**54,339**	**60,424**	**82,932**	**406,332**	.....	.....	**23,558**
September, 1941 (4 weeks)	20,282	59,091	99,151	48,628	188,057	99,042	514,251	.....	.....	23,731
October, 1940 (5 weeks)	47,884	171,049	136,275	147,200	107,000	93,434	702,842	.....	.....	21,919
Ten Months—1941	**268,488**	**1,069,577**	**1,157,563**	**779,168**	**1,228,971**	**746,443**	.....	**5,250,210**	.....	**222,615**
Ten Months — 1940	212,087	749,145	692,721	616,598	546,028	389,236	.....	.....	3,205,815	226,683

OCCUPANCY SPEEDED 35%
FORM COSTS CUT...50%

...because Atlas High-Early cement was on the job!

Earlier stripping and re-use of forms speeded completion and cut form costs

Four stories were added to this two-story structure owned by Spiegel, Inc., Chicago, Ill. *Engineer,* A. Epstein; *Contractor,* Campbell-Lowrie-Lautermilch Corp.—both of Chicago.

TAKE THE WORD of a contractor who knows what he's talking about: *Atlas High-Early cement saves time!* Spiegel, Inc., Chicago mail-order house, needed additional floor space in a hurry. They decided to add four new stories to a 125′ x 325′ two-story structure.

Here's what happened! The contractor specified Atlas High-Early cement for the job, because earliest possible occupancy was essential. He states that this cement speeded occupancy at least 35% and helped cut costs. Forms were stripped in three days' time, much faster than normal portland cement would have permitted, and were reused. Hence, only one set of forms was used, instead of at least two.

Consider Atlas High-Early cement for *your* next job. It more than pays for its slightly higher cost on many jobs. Universal Atlas Cement Company (United States Steel Corporation Subsidiary), Chrysler Building, N. Y. C.

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NR-H-41

ATLAS HIGH-EARLY CEMENT

A UNIVERSAL ATLAS PRODUCT

Engineering examiners seek better law administration

National Council of Engineering Examiners centers attention on better practices in qualifying applicants for professional registration.

Means for improving the handling of applications for professional registration were the chief subjects of interest at the 22nd annual meeting of the National Council of State Boards of Engineering Examiners held in New York Oct. 27-30. Represented at the meeting were 35 of the 44 member boards of the council, the largest registration at any meeting of the council. In addition, members of the Engineers Council for Professional Development, meeting concurrently in New York, took part in the discussion.

Only three states, Montana, North Dakota, and New Hampshire, do not now have registration laws covering the practice of professional engineering, according to the report of T. Keith Legaré, executive secretary. Delaware adopted registration in April of this year, Missouri in August, and an act for Massachusetts was just signed on Oct. 9. Missouri, Massachusetts and Illinois are not members of the council. Mr. Legaré reported that a bill providing for the registration of engineers in the District of Columbia had made some progress in Congress, but due to its undesirable features he expressed the hope that it will not be passed in its present form.

A recommendation from the secretary that the publication of a registered engineers national directory and handbook be undertaken if a satisfactory proposition for the publication of such a directory can be obtained was approved, provided that it involved no financial commitments on the part of the council.

Qualification

Wide divergence in the practices of the several registration boards with respect to the qualifications of applicants for registration were noted by the committee on qualifications for registration. The committee observed that some states lay principal stress on the knowledge of the fundamentals of engineering while others give much greater weight to practical experience. To aid in obtaining greater uniformity in qualifying applicants, the committee presented for adoption an outline of requirements basic to a determination of competence. It also presented for approval a set of general principles to be applied to interviews of applicants for registration, and a set of general requirements basic to all branches of engineering that should be applied in determining whether the four years of qualifying experience required under most registration acts are up to adequate standards. This latter general statement was supplemented by a detailed statement covering civil engineering. Following approval of the committee's report, it was instructed to prepare similar detailed statements for the other major fields. With respect to civil engineering, the report states "All four years should be of a calibre equivalent to that described under and classified as Grade 1 by the American Society of Civil Engineers' Committee on Salaries," as published in the February, 1939, issue of *Civil Engineering*.

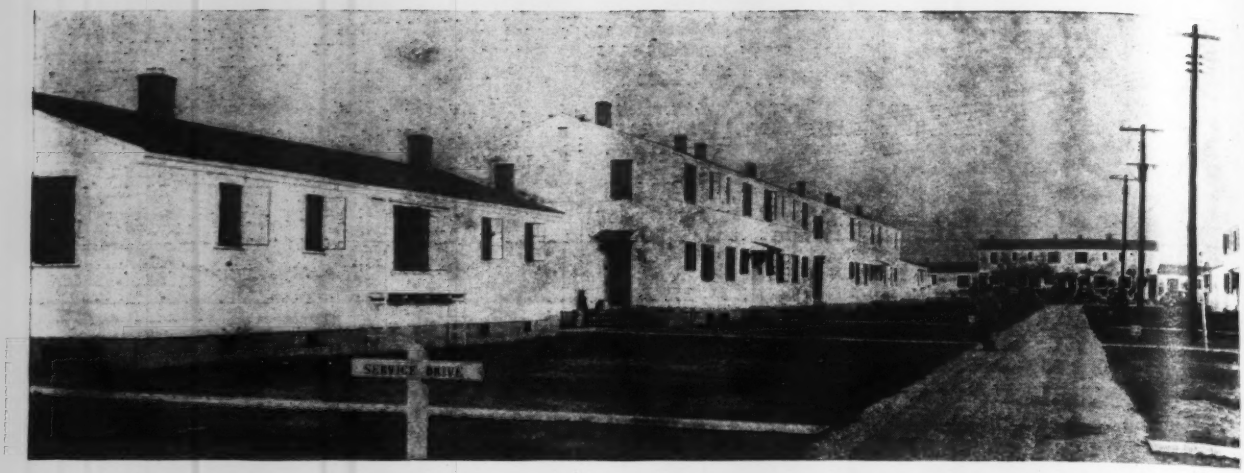
Engineering examinations

Prof. J. H. Dorroh, chairman of the New Mexico board, stated that the preparation of examinations and the grading of papers presented by applicants for registration had not generally reached a satisfactory status. This matter is less serious with respect to examinations in fundamentals, he said, than with professional examinations. In the latter, there is a serious lack of information as to how to bring out satisfactorily the evidence of a man's ability to apply his fundamental knowledge. In discussion it was stated that the committee on qualifications for registration is collecting examination papers and making a study of them in the hope of improving practices in this line.

The committee reported that in about one-fourth of the states the qualifications for registration are substantially below

Start of new year for N.C.S.B.E.E.

C. C. Knipmeyer (right), new president of the National Council of State Boards of Engineering Examiners, takes up plans for the new year with T. Keith Legaré, veteran secretary of the council, immediately following Prof. Knipmeyer's election to office last week.



FWA photo

PBA projects relieve housing shortage in Charlestown, Ind. area

Under assignments of the Federal Works Agency, the Public Buildings Administration has completed 75 homes at Charlestown, Ind., an equal number at Jeffersonville, Ind., and 100 at New Albany, Ind. These dwellings are expected to relieve the housing shortage for the 9,000 workers employed at War Department's powder plant at Charlestown and the 6,500 laborers for the nearby bag-loading plant. Typical of the new homes are those shown above, which are some of the units built at Charlestown.

The Charlestown homes were built by the Marion Development Co., the Grinslade Construction Co., Inc., and the Grinslade Company of Indianapolis; the Jeffersonville dwellings by Dunlap & Co., Inc., Columbus, Ind.; and the New Albany units by Leslie Covin, Indianapolis. Sewer and water main construction, and expansion and street improvement were carried out mainly as WPA projects.

those of the model law. This is especially true of the older laws. The committee urged the council to work more aggressively for improvement of these laws.

Registration laws

Wide divergence of views developed in discussion of the recommendation of the committee on qualifications that the national council ask the Engineers Council for Professional Development to make a study of engineering registration laws and of examining board procedures with the object of bringing out the weak points in the laws and in their administration. Some members of the council maintained that such a study should be a basic function of the council itself, not of an outside agency, while others held that an outside agency would have less hesitancy in pointing out defective laws or in their administration than would the council itself. Chairman Dorroh suggested that E.C.P.D. might accredit state licensing just as it accredits engineering schools, but Dean N. W. Dougherty of Tennessee took strong exception to this view on the basis that practices with respect to registration are matters of state law while the make-up of the curricula of engineering schools is not a matter of law but a matter that can be changed by the faculty of the school at will. Also, he said that he does not believe that divergence between states in the matter of licensing requirements and examination of applicants is as important as some people believed it to be.

Problems raised by efforts to promote reciprocal registration between states for the benefit of engineers who practice in several states were discussed by D. B. Steinman in a report by the committee on interstate registration. The committee stated that insistence on reciprocal registration is a form of coercion toward relaxing responsibility and lowering standards. It urged more general use of "registration by endorsement" under which registration is permissive rather than mandatory, decision in each case being left to the board as to whether it will grant registration to a registered applicant from another state on his record without re-examination.

Effect of registration

Broader aspects of the registration movement were considered in a general discussion of the report of the committee on the effect of registration, presented by Prof. Charles F. Scott. Professor Scott recommended that the council ask E.C.P.D. to prepare a pamphlet for the use of engineering students and young engineering graduates to help them in rounding out their development in the period before they apply to the registration board for admission to practice. President Harry F. Rogers of Brooklyn Polytechnic Institute endorsed the views expressed by Professor Scott as to the desirability of doing more for the young engineers in their formative period and urged the council to co-operate with the professional groups in such work.

The desirability of requiring applicants for registration to give their endorsement to a code of professional ethics as part of their application for registration, as is now done in some states, was put forward as a desirable step in developing professional consciousness. A major obstacle to such practice is lack of a universally acceptable code of ethics for the engineering profession. Development of such a code by E.C.P.D. was recommended as an objective to be sought in the near future.

Question was raised by P. S. Callahan from California as to the legality of asking applicants to subscribe to a code of ethics, stating that in his opinion enforcement of codes of ethics was a function of the professional societies rather than of the registration board. Exception to that view was taken by F. E. Rightor, secretary of the Texas board, who pointed out that under the model law a license can be revoked for unprofessional conduct, and that lawyers look upon subscription to a code of ethics as the best way to define what is and what is not professional conduct.

A feature of the meeting was the annual dinner, attended by representatives of the major engineering societies both in this country and in Canada, at which Mayor La Guardia took a few minutes from his political campaign to talk to the group, urging them as engineers to take a more active part in the new era into which, in his view, we are entering.

C. C. Knipmeyer, professor of electrical engineering at Rose Polytechnic Institute, Terre Haute, Ind., was elected president to succeed Virgil M. Palmer of Rochester, N. Y., and J. H. Dorroh, dean of engineering at the University of New Mexico, was elected vice president. New regional directors elected were George M. Shepard of St. Paul and F. W. Anderson of Lexington, Va. The next meeting is to be held in Indianapolis, Ind.

Long range programming detailed at New Orleans public works congress

Cities in defense areas have filed applications for $800,000,000 federal-aid, delegates hear at meeting of American Public Works Association. F. T. Paul, Minneapolis city engineer elected president.

Municipalities may get direct federal financial assistance for the preparation of plans and specifications for post war public works projects if a bill now before Congress is approved, delegates to the 47th annual conference of the American Public Works Association were told in New Orleans Oct. 26-29. The meeting, which was focused on defense and post war adjustment, featured addresses on long range programming by Frank W. Herring, assistant director of the National Resources Planning Board, by Jacob Baker, consultant on planning for the Federal Works Agency, and by A. D. Morrell, national director of the Public Works Reserves.

Elected president of the association for the coming year was Frederick T. Paul, city engineer of Minneapolis, Minn. Registration of the three day meeting was slightly over 300, including about 100 wives of delegates.

Post-defense program

Mr. Herring urged that every community do as much as possible now to prepare for a post-defense program of public works by undertaking studies of needed projects, preparing plans and, where possible, acquiring land for sites. To make it possible for cities and states to finance these preliminary operations, there has been introduced into the Congress an amendment to the Employment Stabilization Act of 1931. This bill (Senate No. 1617 and House No. 5638) would authorize the making of financial "advances" to local governments, and provide that these allocations should carry such requirements as to reimbursement as the President might specify. (Hearings before the Senate Committee on this bill began last Monday.—Editor)

It is an historical fact, said Jacob Baker, that the amplification of total productivity required by war effort, brings the post war problem of maintaining this productivity in order to prevent unemployment. Expanded public works offers only part of the solution to the problem of coping with unemployment. But if the national psychology is directed toward effective post-war planning now, these efforts may generate the will and the means to prevent a depression.

Objectives of PWR

The Public Works Reserve project, explained Mr. Morrell, is a means whereby local and state governments can coordinate their efforts with the federal government in providing six-year programs of work projects. The objectives are: (1) to accumulate an immediate listing of needed local public projects as a reserve to absorb emergency unemployment; (2) to provide assistance to local governments in assembling data and preparing improvement programs; (3) to relate the state and local programs of federal agencies to those proposals developed by local interests; and (4) to assist state and local government units to make preliminary studies and surveys for selected projects.

Federal grants not anticipated

Discussion from the floor revealed that many municipal administrators believe that participation in the Public Works Reserve would make their communities eligible for federal-aid. It was pointed out quite definitely by federal officials, however, that no federal grants or loan commitments were to be implied or anticipated. The Public Works Reserve activities are designed purely to aid in the formulation of long range programs for public improvements and thus "introduce vision into budgeting and realism into planning," they said.

Some administrators frankly indicated the suspicion that if their communities prepared a long range program, based on ability to finance it, this information might be used against them when and if federal funds should be made available. In answer to this, it was pointed out as not unreasonable to assume that the federal government would favor rather than penalize those communities whose programs were carefully developed.

Problems in defense areas

An unprecedented shift of population occasioned by defense efforts has caused many critical municipal problems in areas where military establishments and industries are located, reported Fred E. Schnepfe, executive assistant, Defense Public Works Division of the Federal Works Agency. Estimates indicate that 2,000,000 to 2,800,000 persons, exclusive of the 1,955,000 in the armed forces, have moved into defense areas. Because local governments have not been able to expand necessary services and facilities to accommodate these people, some $150,000,000 of federal funds were made available for distribution on June 30. But applications for aid at present number 2,952, with a total estimated cost of $844,469,000, reported Mr. Schnepfe.

The Quartermaster Corps is training army city managers on a career basis to administer and operate government cantonments and other facilities representing an investment exceeding two billion dollars, the convention learned from Lt. Col. George F. Lewis, chief of the repairs and utilities branch of the construction division of the Office of the Quartermaster General. These "managers," said Colonel Lewis, have the title of post utility officer and are responsible for maintenance and repair work on buildings, structures and utilities other than fortifications.

A novel estimate of the value of public works in a democracy was made by Gung-Hsing Wang, vice consul of China, who was a guest speaker at the meeting. Said Mr. Wang, "In a democracy the peo-

Frederick Paul (left), new president of the American Public Works Association gets a few words of friendly advice from the retiring president Roy Phillips.

ple come together, share responsibilities, and cooperate with each other to work out something for the general good of the community. Through construction of water supplies, highways, parks and other public works, the idealism of democracy is given practical demonstration."

Officers elected

In addition to Mr. Paul, who succeeds Roy L. Phillips, city engineer, Meadville, Pa., as president, the following officers were elected: first vice-president, Henry L. Howe, city engineer, Rochester, N. Y.; second vice-president, Frederick R. Storrer, city engineer, Dearborn, Mich.; and treasurer, Stuart M. Weaver, executive secretary to the board of commissioners, Montclair, N. J.

New members of the board of directors are William A. Xanten, supervisor, city refuse division, Washington, D. C., and J. M. Graddy, superintendent of public works, Columbus, Ga. Veteran awards were presented to Guy Brown, division engineer, sewerage and paving, St. Louis, Mo.; H. R. Moulthrop, assistant engineer, department of public works, Rochester, N. Y., and W. D. Willigerod, city engineer, East Orange, N. J.

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Snare firm awarded $130,000 in bridge suit

The U. S. District Court at Concord, N. H., last week ruled that $130,000 should be paid the Frederick Snare Corp., New York, as settlement of the company's suit against the Maine-New Hampshire Bridge Authority. The New York firm had petitioned for a refund of $175,000 for extra costs incurred in constructing the piers for the Piscataqua River toll span between Kittery, Me., and Portsmouth, N. H.

The judge ruled that the Snare company was justified in its claim that insufficient time was allowed to verify plans and specifications, particularly those plans with reference to subsurface conditions at the site. The company was found to have been incorrectly fined for 50 of the 152 days extra time required for completion of the firm's contract.

Road builders to meet at Memphis in March

The 1942 convention of the American Road Builders Association is to be held in Memphis, Tenn., during the week of March 2nd, according to Charles M. Upham, engineer-director of the association. Details of the convention will be announced at a later date. There is to be no Road Show this year.

Truman committee upholds Currier bid

No decision on Wayne, Mich., job as Hillman stands by his recommendation that the work should not be given to Currier's firm

With the cards now all on the table, someone in the administration has got to decide whether or not a contract for 300 defense houses in Wayne, Mich., shall be awarded to the low bidder—the Currier Lumber Co. (*ENR*, July 31, 1941, p. 29, and Oct. 9, 1941, p. 473). The Currier firm some weeks ago submitted a bid for the job which was lower by $216,000 than its nearest competitor (The Federal Works Agency originally announced the bid spread as $523,000, but later said that Currier's bid did not include certain utilities covered in the other bids). FWA was about to award the contract to the Currier firm when it was asked by Sidney Hillman of the Office of Production Management, not to do so on the ground that the Currier company employs CIO construction labor and that such an award would tend to upset labor relations in the AFL-dominated building industry.

Senator Truman's committee investigating the defense program held extensive hearings on the Currier case. At their conclusion, Mr. Truman announced on the floor of the Senate his conviction that the contract should go to Currier. "I cannot condemn Mr. Hillman's position too strongly," he said. "The United States does not fear trouble from any source and . . . is able to protect itself.

"The stabilization agreement (*ENR*, July 31, 1941, p. 139) contains no provision (granting the AFL a closed shop), and Mr. Hillman and Mr. Gray, the spokesman for the American Federation of Labor, deny that they were ever given any such promise. If there had been any such promise it would have been a usurpation of the powers of Congress. . . . But if bids by responsible contractors are to be rejected solely because they do not hire AFL men, the government has given the AFL a closed shop . . ."

Hillman defends position

Testifying at the Truman committee hearings, Hillman stood by his contention that the Currier bid ought to be rejected in the interests of over-all labor peace. He denied that the stabilization agreement between government contracting agencies and the building trades department of the AFL constituted a closed shop. He was supported in this view by Gen. Brehon B. Somervell, head of the Quartermaster construction division, who said that of 86 contracts awarded since the agreement was signed, 36 had gone to non-union firms. An apparent contradiction arose in Mr. Hillman's testimony on this point when he admitted that "the agreement is applicable only to those projects where members of the American Federation of Labor are employed." The agreement itself provides that all federal defense construction "shall be governed by this labor policy."

Mr. Hillman argued that his recommendation in the Currier case was based on his general duty of encouraging good labor relations rather than on the stabilization agreement. He admitted, however, that his action in the case was taken through the board of review set up under the agreement. Mr. Hillman said a general construction strike had arisen in Detroit last May from a dispute involving Currier and the AFL teamsters. He said he feared a repetition of the trouble if Currier got the job.

AFL spokesmen denied any intention of calling a strike over the issue but said their members were so angry about it that if the contract were awarded the union leadership would be unable to control them.

Col. Lawrence Westbrook, head of FWA's Mutual Ownership Housing Division and the man in immediate charge of the Wayne job, said he considered himself bound by OPM's recommendation and planned to reject all the bids and call for new ones. Asked what would happen if Currier were again the low bidder, he said he would reject the bids again.

Administration's dilemma

There is as yet no clear indication of what action will be taken on the problem. It is a tough one. To award the contract would be to jeopardize the administration's whole policy of achieving wartime labor controls through the unions rather than by legislation—a policy which seems to be bound up with Mr. Hillman's program of recognizing the dominant union in each industry. On the other hand, it is very difficult for an executive agency to disregard the clearly expressed intent of a Congressional committee—especially when the committee is generally supported by the public and the press.

Some indication that the Truman committee has been under pressure to go easy is seen in the fact that it abandoned its original intention of submitting a formal report to Congress. Instead, Senator Truman contented himself with a verbal statement on the floor of the Senate. According to Senator Truman's office, his statement has the support of all the other committee members except Senator Mead. Mead told the Senate that he saw logic in Mr. Hillman's position, that the Currier firm has been "a notorious wage-cutting organization," and that the AFL could be expected to resist with "strife and difficulties" an attempt by the CIO to invade an AFL field.

Better guidance for young engineers considered at E.C.P.D. meeting

Engineers Council for Professional Development gives active attention to student guidance and the problems of young engineers at its ninth annual meeting in New York

Improved means for meeting the educational problems of young engineers and engineering students were the principal subjects of discussion at the ninth annual meeting of the Engineers Council for Professional Development held in New York City Oct. 29–30. Other subjects covered were expansion of the council to include representatives of additional engineering organizations, progress in accrediting of engineering schools, closer cooperation with the National Council of State Boards of Engineering Examiners in the improvement of registration laws and development of a code of ethics for the profession.

R. E. Doherty, president of Carnegie Institute of Technology, was elected chairman for a second term and H. T. Woolson, executive engineer, Chrysler Corp., was re-elected vice chairman. H. H. Henline, secretary, American Institute of Electrical Engineers, succeeds George T. Seabury, secretary of the American Society of Civil Engineers, as secretary of the council.

Improvement in the financial position of E.C.P.D. was reported by Mr. Seabury due to the fact that several of the sponsoring organizations have doubled their contributions to the council, the mechanical and electrical engineers having raised theirs to $1,700. The civil engineers are expected to take like action in January. The principal advantage of the increase in income will be elimination of the fee heretofore charged engineering schools for the examinations made in connection with accrediting the courses at the schools. Those fees have been a source of trouble in the past.

Accrediting engineering schools

Good progress in accrediting was reported. 461 engineering curricula at 129 schools now have been accredited and provisional accrediting has been granted for 104 additional curricula. No decision has been reached on the matter of accrediting technical institutes, a subject under consideration for over a year.

The committee on engineering schools again went on record as being opposed to the accrediting of specialized curricula.

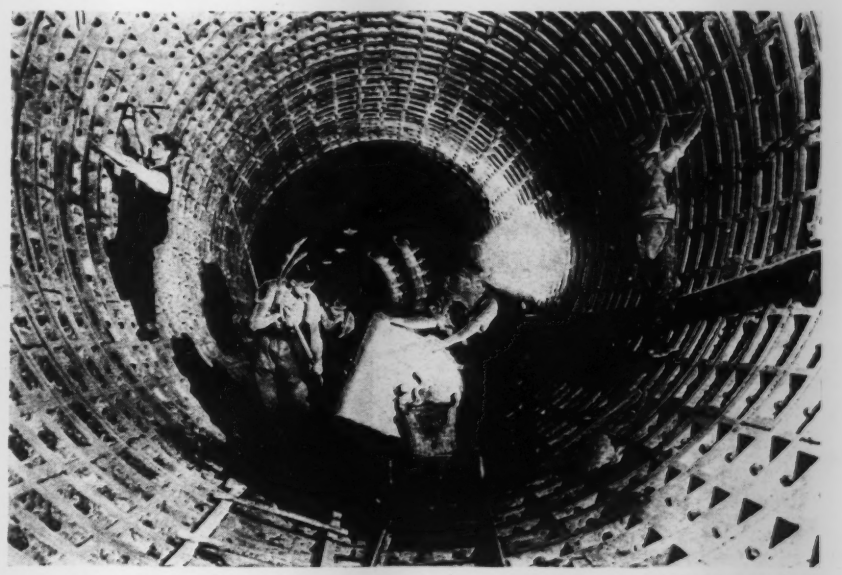
Expansion of E.C.P.D. by admission of representatives from engineering organizations other than the eight now making up the council was discussed in considering application of the Institute of Ceramic Engineers for membership in E.C.P.D., but it was decided that expansion of the council to include representatives of the 80 odd specialist organizations that might seek membership would make it too large a body for effective action. Specialist groups were urged to cooperate through their membership in the civil, mechanical, electrical, chemical and mining engineering societies.

Publication of a revision of the E.C.P.D. pamphlet for the guidance of high-school students under the title "Engineering as a Career" was authorized. Subsequently, in committee reports, publication of a similar pamphlet for the aid of engineering students and young graduate engineers was proposed. Also proposed was a pamphlet relating to trade unions in the professional fields.

Student guidance

Encouraging progress in student guidance was reported by S. D. Kirkpatrick, chairman of the committee on professional training, notably that done in New York City schools by the joint committee headed by Arthur G. Hayden. Mr. Kirkpatrick urged further work of a like nature in helping the young engineers just out of college. In this, he said, the sponsoring societies can be most helpful by closer cooperation with E.C.P.D. A new problem, Mr. Kirkpatrick said, is that raised by men being taken into engineering work in connection with the defense program without adequate training in engineering.

(Continued on p. 59)



British Combine photo

London builds tunnels as bomb shelters

A unique war development in the extensive system of underground railways in London is the construction of deep-level "tube" tunnels for present use as bomb shelters. Later these will be utilized as links in the extension of the city's railway system. In a note on the tunnel shelters in The Engineer, London, the lengths of these new tunnels are not stated, but 18 out of some 20 shafts planned have been started it is reported. Plans provide for sheltering some 90,000 people with the first shelter to be completed in November.

The work is being done and paid for by the government, with advice and assistance from the London Passenger Transport Board, which operates the railways. But there is no definite agreement on the part of the board to use or purchase the isolated tunnel sections, which are expected to cost about $5,300,000.

A recent report on British government expenditures points out that this form of bomb protection costs some $60 per person, as against $16 for other types of shelters. It is also impossible to see now in what direction new local railway extensions may be needed after the war, or whether money will be available to build them. Furthermore, to provide for a relatively small number of refugees, this construction makes a heavy demand on labor, equipment and materials when these can ill be spared.

The plan also conflicts with the principle of dispersion of refugees and is open to serious objection as to health and sanitation. Recommendation based on these conditions is that no more shelters of this particular type be built.

Aluminum Company plans plant addition at Massena

To supply stock for the manufacture of forgings for airplane motors and fittings, and rod, bar and wire for national defense industries, The Aluminum Co. of America plans to erect a second blooming mill at their Massena, N. Y. plant. The mill and its necessary facilities will be housed in a steel and brick building covering an area of more than 450,000 sq.ft. A completely new melting department will be established to serve the blooming mill.

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First construction report from Bureau of Commerce

The newly revived construction section of the U. S. Commerce Department's Bureau of Foreign and Domestic Commerce has issued the first of a series of monthly reports on the trends and status of the construction industry. Volume of construction in August, according to the report, was at an annual rate of ten billion dollars.

Much of the report deals with problems of material shortages; in September, it is pointed out, more or less well justified fear of shortages was more of a retarding factor than shortages themselves. Next month's report, it is understood, will indicate that these fears are now being realized.

The reports can be obtained, at a dollar a year from the Bureau's Washington office.

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Indiana may not obtain funds for highway work

The Indiana Highway Study Commission, authorized by the last session of the state legislature, in a recent resolution pointed out that Indiana will face a serious financial problem if the state highway commission fails to receive the $1,250,000 annual revenue fund anticipated under the new license fee schedule. The 1941 legislature increased the legal weight limit for truck traffic on Indiana highways. At the same time the body repealed previous weight taxes and substituted a higher license revenue act at the "insistence of individual and organized commercial haulers."

The Study Commission now reports, "It is now alleged that this substitute license measure is legally defective due to a faulty title, and at least one organization of haulers plans to ask the courts to set it aside." Nullification of the act by court action is seen as resulting in loss of revenue sorely needed.

About $1,600,000 was raised annually by the weight tax measure that was repealed.

JOBS OF THE WEEK

DEFENSE HOUSING, Long Beach, Calif.
Zoss Construction Co., Los Angeles, Calif., has been awarded a $1,41[illegible]20 contract for constructing 600 defense housing units for the Division of Defense Housing, Federal Works Agency, Los Angeles. The contract for the site development work went to Myers Brothers, Los Angeles, at a price of $304,733. Eugene Weston, Los Angeles, is architect for the project, and Harold Barmett, Pasadena, is engineer.

FLYING FIELD, Lake Charles, La.
T. L. James & Co., Inc., Ruston, La., was awarded a $1,301,263 contract for the grading, drainage, and paving of aprons and runways at flying field of the advanced single-engine school at Lake Charles. U. S. Engineers, New Orleans, awarded the contract.

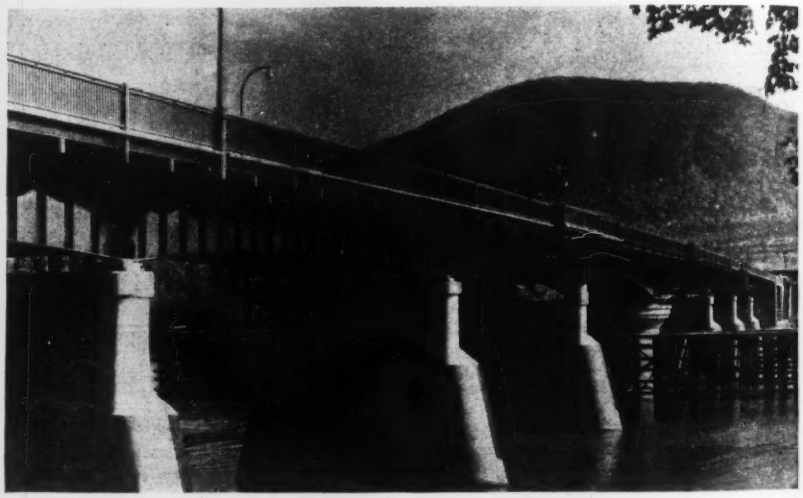
SUPERSTRUCTURE OF OCEAN TERMINAL, Mobile, Ala.
United Construction Co., Winona, Minn., has been awarded a $1,130,753 contract for constructing the superstructure for an ocean terminal at Brookley Field. U. S. Engineers, Mobile, are doing the work.

HIGHWAY BRIDGE, Virginia.
Bowers Construction Co., Raleigh, N. C., with a bid of $555,060 was low bidder for constructing a 1,417-ft. long highway bridge over Rappahannock River and for improving approach roads in Stafford and Spotsylvania Counties when the Virginia Department of Highways, Richmond, opens bids.

COLLEGE BUILDINGS, Chicago, Ill.
R. C. Wieboldt Co., Chicago, Ill., got the contract for constructing the college buildings for Illinois Institute of Technology, Chicago. Holabird & Root, Chicago, are architects for the work, which is estimated to cost $3,000,000.

DREDGING, New York, N. Y.
Great Lakes Dredge & Dock Co., New York, N. Y., has been awarded a $1,271,226 contract by the U. S. Engineers, New York, for 2,832,500 cu. yd. of dredging from Liberty Island Anchorage. Work does not include removal of ledge rock.

NOTE—Additional bidding and contract news on over 800 projects large and small appear in the Construction News sections beginning on page 133.



New bridge replaces ferry on important Quebec route

Built at a cost of $525,000, a new highway bridge consisting of a 258-ft. central swing span flanked on each side by a 103½–102–103½-ft., three-span continuous, plate-girder unit and a 66-ft. reinforced-concrete approach span, was placed in service Sept. 22 over the Richelieu River as an important link on the Montreal-St. Hyacinthe, Quebec, highway. The new bridge replaces a ferry-boat service. The flooring of the bridge is of reinforced concrete with the exception of that on the swing span, which consists of creosoted wood flooring covered with asphalt planks. The roadway is 33 ft. wide and a 5-ft. walk is provided on each side.

Construction work started the latter part of June, 1940. The new crossing was built by the Department of Public Works in the Province of Quebec, with Hon. T. D. Bouchard, minister of roads, and O. Desjardins, chief engineer. Atlas Construction Co., Ltd., Montreal, was the contractor for the substructure work, while Dominion Bridge Co., Ltd., Montreal, did the superstructure work.

PRIORITIES GUIDEPOST

Current notes on what, who and how

DISTRIBUTION OF STEEL, over the next few months, is to be gradually shifted to an allocation rather than a priority rating basis. SPAB has directed the Priorities Division to do this in line with Donald Nelson's long-range objective of substituting definite allocations for priority ratings. First step in the present plan will be to order the steel companies to deliver definite tonnages on a specified delivery schedule to certain Army and Navy projects. The steel that is left over will then be distributed by the steel companies, as at present, in accordance with priority ratings. Gradually the number of projects given allocations will be stepped up until all direct military jobs are on this basis. At a later stage, the allocation procedure may be extended to indirect defense and essential civilian jobs, probably by alloting certain tonnages to broad categories of use—so much to roadbuilding, so much to manufacture of agricultural machinery, etc.

Some types of iron and steel are already allocated notably pig iron and ship plate.

DETAILS of the P-19 project rating form used for construction projects are now being restudied. At present five forms of this rating are used: P-19 itself is applied to projects outside the continental U. S. and may be used in buying anything needed. P-19a, the most common, is restricted to purchases of items on the Priorities Critical List. P-19b is a rarely used form incorporating so-called frozen delivery schedules, meaning that deliveries are guaranteed even though other orders should be placed bearing a higher rating; this is essentially a form of allocation. P-19c is no longer used. P-19d is used for defense housing and incorporates a special housing critical list. P-19e, described in our last issue, is for defense roads.

Consideration is being given to modifying all the forms to make then resemble the P-19e type in eliminating reference to the critical list (except P-19d) and in making it impossible to extend the rating except for items to be physically incorporated in the project.

This last change would mean that a manufacturer of construction equipment who received a rated order could not use the rating to buy material for the equipment, while a rolling mill with a rated order for I-beams could use the rating to get ingots.

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E.C.P.D. meeting

(Continued from p. 57)

A highlight of the meeting was the report of J. B. Challies, representative of the Engineering Institute of Canada. Noting that it is only a year since the institute joined E.C.P.D., Mr. Challies said that Canadian engineers have not had time to take up such matters as accrediting of engineering schools, but expressed confidence in the ability of Canada's engineering schools to meet the standards of E.P.C.D. Canadian engineers, he added, are working for the objectives of E.C.P.D. as best they can in the present emergency, but all such objectives must be secondary to the nation's central objective of the present moment, that of helping the mother country win the war.

George W. Burpee, reporting on the relations of the American Society of Civil Engineers to E.C.P.D., stated that the board of direction of that society, at its recent meeting, had notified eleven schools where the civil engineering course has not yet been accredited by E.C.P.D. that the charters of student chapters at those schools will be withdrawn unless they have obtained such accrediting by Jan. 1, 1944.

Practicing engineers should be encouraged to take a more active part in the vocational guidance work of the engineering societies and in the administrative work of engineering schools, said Dean R. A. Seaton, Kansas State College, representative of the Society for the Promotion of Engineering Education. Dean Seaton urged E.C.P.D. to work for more uniformity in membership requirements in the engineering societies.

Development of a code of ethics that would be generally acceptable within the engineering profession was discussed at considerable length, following a recommendation by the committee on ethics that the committee on professional recognition prepare a statement on the broad philosophy of ethics and the influence of ethical principles in a profession. C. C. Williams, president of Lehigh University, urged E.C.P.D. to explore the fundamentals of ethics as they apply to engineering as a basis for the formulation of a code of ethics.

Portland plant built for prefabrication of timber materials

Recently, Timber Structures, Inc., completed a new plant at Portland, Ore. for the prefabrication of timber building parts. The plant is a 120x140-ft. wood structure with the roof supported by two bays of 60-ft. span timber bowstring trusses and with three 40-ft. span carrying trusses down the center. This design calls for only two interior posts in the entire area.

The clearance provided between the lower chord of the trusses and floor level is 20 ft.

Roald & Schneider, Portland, designed the building, and Knott, Rogers & Dunbar, general contractors of Portland, supervised its construction.

Housing jobs not awarded

In Jobs of the Week, Oct. 23, it was erroneously reported that prefabrication of 600 Elmhurst, Ill. dwellings had been awarded to American Rolling Mill Company, Middletown, Ohio. This contract was not awarded.

OBITUARY

ENGELBERT C. LAWRENCE, 66, civil engineer of Catonsville, Md., for 30 years associated with the U.S. Fidelity & Guaranty Co., died in Baltimore, Md., Oct. 25. Mr. Lawrence, before joining the Fidelity firm, worked with the Baltimore & Ohio R.R., and for some time as engineer with the Harbor Board of Baltimore.

W. W. HARMON, 68, from 1922 to 1936 city engineer of Oakland, Calif., died Oct. 24 in that city. Mr. Harmon, a graduate of the University of Minnesota, first worked in the West as engineer with the Northern Pacific R.R. At the time of his death Mr. Harmon was engineer with the Calaveras Cement Co.

MILTON G. MCKIMMEY, 68, resident civil engineer for the Missouri and Arkansas Ry., died at Harrison, Ark., Oct. 28. Mr. McKimmey had been with the Missouri & Arkansas line for 41 years.

MALCOLM C. CLEVELAND, 64, former chief engineer of the New York Public Service Commission, died Oct. 31 at Shrewsbury, N.J. For 17 years he was valuation engineer and assistant chief engineer of the Lehigh Valley R.R. Following service with the New York Central, Michigan Central and other railroads, in 1931 he was appointed chief engineer of the public service commission. He held that position until his retirement in October last year.

JOSEPH E. BERARD, 50, president of the Springfield (Mass.) Home Builders and Contractors Association, died Oct. 30. At the time of his death he was in charge of a Springfield housing project of 400 units.

FRANK H. MAHAN, 71, president of the Frank H. Mahan & Sons, died at Newton Square, Pa., Oct. 27.

CONTRACTS AND CAPITAL

ENGINEERING CONSTRUCTION awards for the short week due to the Election Day holiday total $44,209,000, a decrease of 44 percent from the volume for the corresponding week last year.

Private awards are 50 percent below a year ago, and public construction is 42 percent lower. State and municipal construction is 59 percent lower than in the 1940 week, and federal work declines 31 percent.

The current week's total brings 1941 construction volume to $5,294,419,000, an increase of 61 percent over the 45-week period last year. Private awards for the period are up 9 percent, and public construction is 83 percent higher as a result of the 189 percent gain in federal work.

In the classified construction groups, gains over last week are reported in waterworks, sewerage, bridges, commercial buildings, earthwork and drainage, and streets and roads. Increases over the week last year are in waterworks, sewerage, earthwork and drainage, and unclassified construction.

New capital for construction purposes for the week totals $129,704,000, a gain of 163 percent over the volume for the week last year. The week's new financing is made up of $3,704,000 in state and municipal bond sales, $1,000,000 in RFC loans for public improvements, and $125,000,000 in federal appropriations for plant construction under the Second Lend-Lease Act.

New construction financing for the year to date, $6,218,910,000, is 74 percent higher than the $3,582,793,000 reported for the 45-week period in 1940.

CONTRACTS
(Thousands of dollars)

	Week Ending Nov. 7 1940	Oct. 30 1941	Nov. 6 1941
Federal	$34,461	$42,880	$23,658
State & Municipal	22,539	23,453	9,276
Total public...	$57,000	$66,333	$32,934
Total private..	22,645	36,360	11,275
TOTALS	$79,645	$102,695	$44,209
Cumulative 1941.....(45 weeks)			$5,294,419
1940.....(45 weeks)			$3,285,469

Note: Minimum size projects included are: Waterworks and waterways projects, $15,000; other public works, $25,000; industrial buildings, $40,000; other buildings, $150,000.

NEW PRODUCTIVE CAPITAL

	1940 45 weeks	Cumulative 1941 45 weeks
NON-FEDERAL	$1,300,832	$1,267,792
Corp. Securities....	216,410	322,114
State & Mun.....	446,036	388,683
U.S.H.A. loans	218,704	30,200
R.F.C. loans.....	195,682	263,991
R.E.A. loans	40,000	100,500
Federal Aid—Hwy..	184,000	163,000
FEDERAL	$2,281,961	$4,951,118
TOTAL CAPITAL....	$3,582,793	$6,218,910

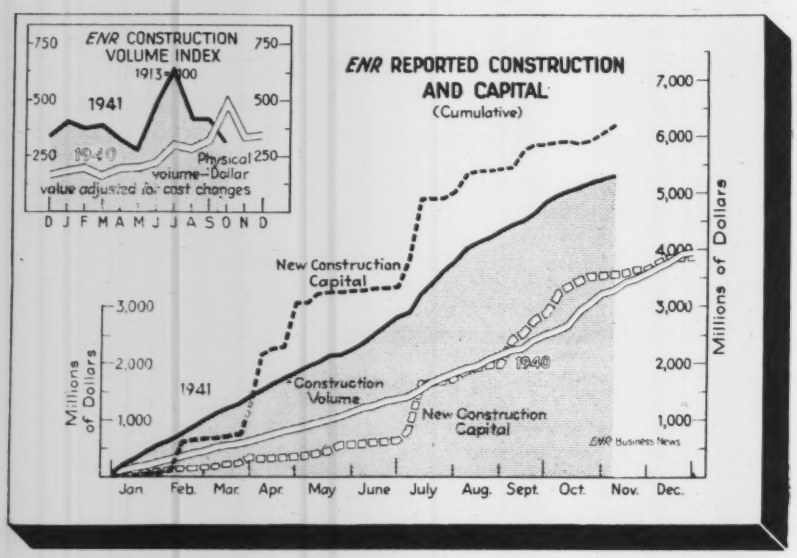
FHA MORTGAGES

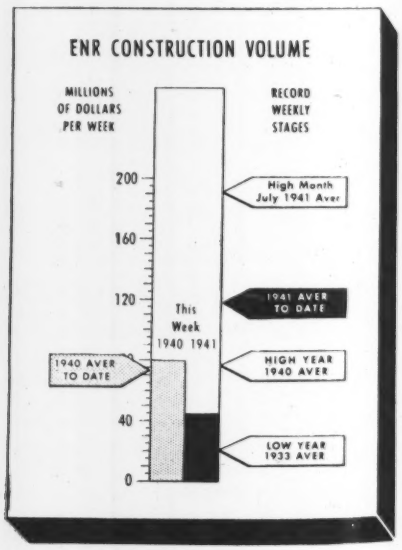
	Week Ending Nov. 2 1940	Oct. 25 1941	Nov. 1 1941
Selected for appraisal (Titles II and VI)	$18,728	$24,954	$25,257*
Cumulative 1941.....(44 weeks)			$1,244,893*
1940.....(44 weeks)			$1,102,638*

* Subject to revision.

ENR INDEX NUMBERS

Index Base=100	1913	1929
Construction Cost...Nov. '41	266.13	127.9
Building Cost.....Nov. '41	216.54	117.6
Volume .....Oct. '41	263	115




ENR CONSTRUCTION VOLUME
MILLIONS OF DOLLARS PER WEEK
RECORD WEEKLY STAGES
High Month July 1941 Aver
1941 AVER TO DATE
This Week 1940 1941
1940 AVER TO DATE
HIGH YEAR 1940 AVER
LOW YEAR 1933 AVER

Comment and Discussion

Readers' opinions on matters that concern engineers and contractors

Bomb-Resistant Construction

Sir: I should like to call attention to an error in the table entitled "Thicknesses to Protect Against Bomb Fragments", in the article by Prof. Rose and myself, *ENR*, Aug. 28, 1941, p. 62. The last item mentioned in this table is "wood", whereas it should be "wool". The main reason we inserted the item, which came from British sources, was that there has been some discussion over here of the use of cotton bales to resist bomb fragments.

A slightly different type of error occurs in the article "Buildings Under Bombing", by Otto Bondy, *ENR*, Aug. 14, 1941. In the table on p. 66 are given thicknesses of mild steel that are penetrated by various weights of bombs. These thicknesses are much larger than they should be, according to the quoted source, namely British A.R.P. Handbook No. 5. Thus a 110-lb. bomb will perforate 3.9 in. of steel instead of 3 ft. 9 in.; a 220-lb. bomb 4.7 in. instead of 4 ft. 7 in., and a 660-lb. bomb 6.7 in. instead of 6 ft. 7 in. The thicknesses given for the heavier bombs are correct.

HAROLD E. WESSMAN
Chairman, Department of Civil Engineering
New York University

Welded Beam Connection Standards

Sir: As a result of always reading your Comment and Discussion page, in which I have found many valuable comments, I notice in the current issue of Oct. 9, 1941, suggestion by Mr. James D. Marshall of the growing demand for standard welded beam connections.

Mr. Marshall is so correct on this matter that, knowing the need for this information, our office some time back made up such a set of standards, which is published in manual form by J. H. Williams & Co., 400 Vulcan Street, Buffalo, N. Y.

I believe announcements of this manual have appeared in some of the engineering journals, which Mr. Marshall evidently missed seeing.

This manual gives all welded connections equivalent to the A.I.S.C. Standard riveted connections for all rolled steel beams.

Further, the welded connections are shown in two ways: The first method using the direct web-welded connection similar to the method shown in the 1938 Edition of American Welding Society "Welding Handbook" on page 938 and figure "b" on page 984; and the second method based on using web angles for the welded connection in a manner similar to the web angles used for riveted connections.

We prefer the first method of direct web weld, having used this method on thousands of connections made during the past ten years. It is the most direct and positive method and we believe it gives the best results as has been fully demonstrated by the results we have secured under all conditions of load and span.

VAN RENSSELAER P. SAXE
Consulting Engineer
Baltimore, Md.

How a Defense Public Works Office was Organized

Sir: The defense program has caused many organizations to be created rapidly and put in service under conditions which have never been known to the engineering profession before. A typical example of such speedy organization is the creation of the regional organization of the Defense Public Works Division of the Federal Works Agency, which was set up to serve the states of Texas and Louisiana.

On Saturday, June 28, 1941, the regional director, G. F. Harley, and the assistant regional director, the writer, arrived in Fort Worth, Tex., from Washington, D. C., with instructions to organize the regional director's office and assign personnel to duty. Before midnight June 30, fifty-six employees had been assigned to duty. On July 2, a regional conference, attended by members of the Federal Securities Agency, the National Resources Planning Board, defense councils and planning boards, health departments, educational departments and other departments of the two States, as well as representatives of the U. S. Public Health Service and U. S. Department of Education, was held in Austin, Tex., for the purpose of crystalizing a defense public works program for Texas and Louisiana.

On July 7, a series of conferences was commenced which, within the ensuing sixteen days covered the defense areas in Texas and Louisiana and actually catalogued a large number of worthy defense projects. Also on July 7, the regional office received its first application and subsequent to that date, but prior to Aug. 1, 116 applications were received totalling $29,904,884 in estimated construction cost.

The regional director's office was organized with the regional director and the assistant regional director as the chief administrative officials. Engineering, legal and finance sections completed the regional office set-up, with the chief of each section being appointed by the Washington office. By July 11 also, four project engineers offices were established in the critical defense areas of the two states.

UEL STEPHENS
Ass't. Regional Director,
Defense Public Works
Region No. 8
Fort Worth, Texas

A Correction

An error occurred in stating the size of the lamella roof units mentioned in the "Sports Arena for Army's Off Hours," which appeared in the Oct. 23 issue, p. 114. The size of these roof members was inadvertently indicated to be 2x12 in., whereas the sizes called for in the design are as follows for the different climatic zones:

\+ 20 deg. zone — 3x14 in. lamella
0 deg. zone — 3x14 in. lamella
— 20 deg. zone — 3x16 in. lamella

This type of design has been used principally in the +20-deg. zone with some buildings at camps in the 0-deg. zone. The alternate design of segmental steel arch has been used exclusively for camps in the — 20-deg. zone.—EDITOR.

EDITORIALS

VOLUME 127 NUMBER 19

November 6, 1941

Designing to Save Steel

OPM's REQUEST for a reduction in the number of structural steel shapes to be rolled after Feb. 1, 1942, emphasizes a condition with which designers are already familiar, namely the frequent unavailability of the particular shape that will give the maximum economy. So far as safety is concerned it is, of course, possible to get along with only a very few sections, and these are amply provided in the OPM approved list. In this connection an article in this issue presents capable structural engineer's thoughtful analysis of the problem of designing to save steel. Significantly, one of his conclusions is that available steel sections could readily be confined to about half those listed in steel catalogs, which corresponds closely to OPM's decision. His principal recommendation is to make sections deeper, not only in structural steel but in concrete framing. Total costs may be greater, but steel will be saved. It is a timely and thought-provoking article that every designer should read.

Just for Fun

IF THE TRUTH WERE ADMITTED it would probably reveal that many of the world's great scientific discoveries, as well as a majority of the lesser developments in the various branches of engineering, originated with someone trying an experiment "just for fun". The idea of some genius marshaling a test tube and slide rule offensive against some obstacle to human progress is a pretty picture, but it is largely imaginative art painted after the fact. Take, for example, the development reported on another page of this issue of adapting a spheroidal steel tank to building purposes. George Horton, president of the Chicago Bridge & Iron Co., who originated the idea, frankly admits that "We did it for our own amusement." Although the whole idea could have been a complete failure, actually it turned out to be a successful building in every respect, and demonstrated that thin steel plates can be used for self-supporting dome roofs of wide span. Whether it meets any compelling need in the building field is something the future will have to decide. Mr. Horton doesn't care. He had fun in designing and building it, and it serves the purpose for which it was intended. Engineers and contractors will look a long time for a philosophy that is any better than Mr. Horton's. Get fun out of your job, try things "just for the hell of it." The result is often surprisingly good.

Engineered Buildings

THE NEED FOR WIDER BAYS in airplane factories, created by the steadily increasing size of bombing planes, has been met so readily that we are apt to overlook the fact that an important development is taking place: Buildings are requiring a higher order of engineering knowledge than ever before. It is possible to go from a 50 to a 100-ft. span without calling upon any additional knowledge, but when the span is pushed to 200 ft., as it has been in numerous cases, or to 300 ft., as it has been in several, the problem becomes more difficult. The first 300-ft. trusses, used in a Glenn Martin building in 1937, had chord stresses of one and a half million pounds, and those in the 300-ft. Boeing trusses, described in this issue, are almost as large. The resultant members are more common in bridge than in building trusses. Also the loads to be carried—20 tons at a single panel point from a crane or 80 tons distributed over the full span by a door—are quite similar to those required in bridge practice. Indeed it is knowledge gained in bridge engineering that permits the design and erection of these new buildings just as though they were conventional and familiar structures. Here again is demonstrated how experience gained in one field is useful in another, in short how civil engineering advances because its practitioners work in many fields.

A New Tool

THE JOB OF STOPPING THE FLOW of the Tennessee River under Hales Bar Dam, described in this issue, has developed a new construction technique and extended the use of the calyx drill, originally developed for subsurface explorations, to the job of salvaging foundations. Used to prepare a trench for underwater placing of a continuous concrete wall, the drill method represents the latest in a long series of famous repair operations that have sought to make Hales Bar Dam watertight. Whether or not this cutoff wall is the final solution to difficulties at Hales Bar Dam will be proven only by time. Comment, appearing 15 years ago in these pages, expressed confi-

dence that asphalt grouting had stopped the flow, but water in quantity again found its way through the treacherous foundations. Nevertheless this latest attempt, which seems to go all the way in plugging the leaks, warrants a new expression of confidence. At the very least it introduces a new tool for subaqueous work that may have wide usefulness.

Better Main Highways

VISIONARIES lacking practical highway experience have brought the term "superhighway" into a certain amount of disrepute by their schemes for crisscrossing the country with a network of roads bearing little or no relation to actual needs or physical limitations of the terrain. For that reason one hesitates to characterize the Wilbur Cross Parkway in Connecticut as a superhighway, yet in the better sense of the term it is properly so classified for it lies close to an air line between two major centers of population, New York and Boston; it is so located as to facilitate movement between local points of industrial concentration; it avoids passing directly through cities along its route; it has all major intersections separated; and it provides adequate roadways for present traffic. In brief, Wilbur Cross Parkway typifies what many state highway departments are doing within their limited budgets to provide the nation with a better system of main trunk highways, without all the fanfare that accompanies the visionary schemes.

For a Better Profession

EVIDENCE that the profession is succeeding in its efforts to raise the basic training standards for engineers was unusually apparent in the annual meetings in New York last week of the National Council of State Boards of Engineering Examiners and the Engineers Council for Professional Development. Widespread recognition in secondary schools of the value of student guidance and selection, better and more uniform curricula in engineering schools, almost universal acceptance of accrediting of curricula in the engineering schools as something more than a mere formality, progressive improvement in registration laws and a vast improvement in their administration—these are some of the developments that can be recorded as having come about through efforts that have centered in one or the other of these two agencies.

Outstanding in this record is the accrediting of engineering school curricula, which now has reached the impressive total of 461 in 129 schools, with 104 more curricula provisionally accredited. But the true significance of this accrediting lies in the use to which it is being put. At the E.C.P.D. meeting it was announced that the American Society of Civil Engineers had notified eleven colleges that the charters of student chapters of the society at these schools will be withdrawn if accrediting of their civil engineering course has not been obtained by 1944. Also, more and more state examining boards are using E.C.P.D. accrediting as the basis for determining whether an applicant's scholastic training is of satisfactory character.

Less spectacular, but very much worth while as a means for attracting the right type of boys into engineering while at the same time turning away obvious misfits, is the work of student guidance now carried on regularly in many high schools under the auspices of E.C.P.D.

So much for past accomplishment. Looking ahead, in both the E.C.P.D. and N.C.S.B.E.E. meetings there was insistent demand that the E.C.P.D. devote more attention to developing aids for engineering students and young engineering graduates, particularly along the line of personal advice and counsel from the older men. From the angle of the engineering examiners, an attempt by E.C.P.D. to define the types of practical experience that engineering graduates should obtain in the period before they are eligible to apply for registration would also be of great help. Here is a field of activity the surface of which has only been scratched by E.C.P.D.

Training young engineering graduates, in the long view, should be the chief concern of E.C.P.D. Accrediting of engineering curricula hereafter will be largely automatic, and the form that student guidance work should take is now fairly clearly defined. How best to help the young graduate make the most of his possibilities is still unanswered. Looking at the record of accomplishment of the nine years since E.C.P.D. was founded, there is little reason to doubt that an answer will be found in the near future.

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Fig. 1. Concrete paver and two finishers on the Wilbur Cross Parkway starting the second lane of the pavement.

Wilbur Cross Parkway Extended

***Contents in Brief**—Nine miles of 22-ft. concrete pavement is now being built on what ultimately will be one lane of the eastern end of Wilbur Cross Parkway, a superhighway crossing the state of Connecticut close to an air-line route between New York and Boston. Grading for one roadway on the section now being paved was completed in 1939 and since then about half the graded section has been in service, a temporary surface treatment having been put on the gravel subgrade for that purpose. As part of the work now in progress the shoulders are being widened beyond those originally contemplated to meet military requirements.*

Up Near the Northeast Corner of Connecticut the state is building nine miles of what ultimately will be the eastern end of Wilbur Cross Parkway, a superhighway crossing the state diagonally from the eastern end of the Merritt Parkway to the Massachusetts line to form a major link in a new through route between New York and Boston. From the eastern end of the Merritt Parkway through traffic now follows U.S. 1 along the coast or works its way by devious routes across country.

The location for the Wilbur Cross Parkway as far as it has been determined is shown in Fig. 3. Completed portions are the connections to Merritt Parkway and U.S. 1 west of New Haven and a section that extends as far as the intersection with State Route 34, which the state highway department is developing into a superhighway to give New Haven a second outlet to the west. Also being completed are about eleven miles between Meriden and Hartford where U.S. 5 has been rebuilt as a dual highway. The bridge to carry the parkway across the Connecticut River into East Hartford is under construction, but between East Hartford and Tolland Station no definite location for the parkway has been selected. From Tolland Station to the Massachusetts state line, one roadway was graded in 1939; from the point where that graded line crossed Route 15 to the state line a surface

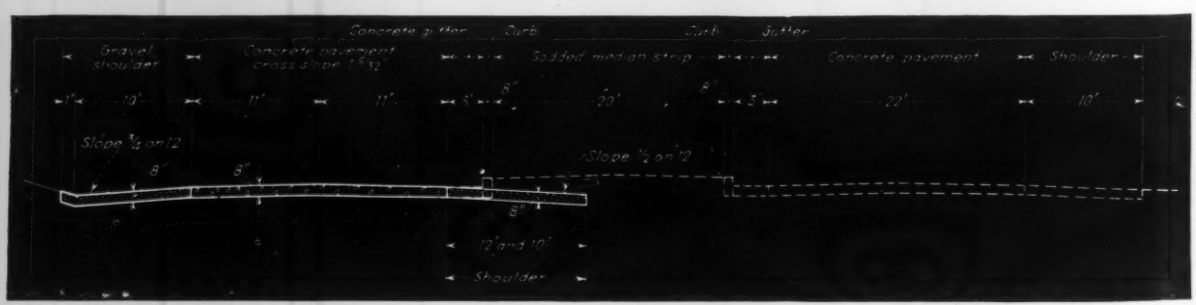


Fig. 2. A section through the pavement now being laid at the northern end of the parkway, showing its relation to the projected dual-lane construction proposed ultimately for Wilbur Cross Parkway.

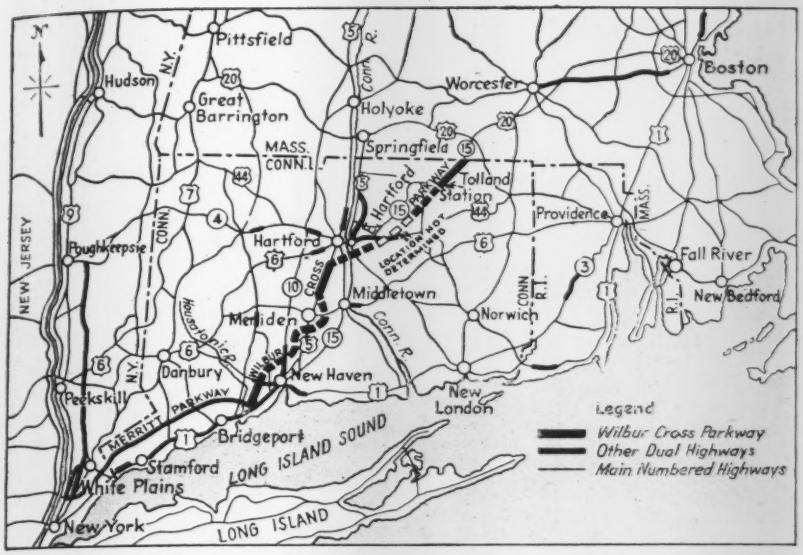


Fig. 3. When completed, the Wilbur Cross Parkway will extend diagonally across the state of Connecticut, connecting at its western end with U. S. Route 1 and the Merritt Parkway west of New Haven, and at its eastern end with Massachusetts highways leading to Boston.

treatment was put on the gravel subbase and the road was used to avoid a bad hill on the old road until it was closed off for the paving operations now nearing completion. Beyond the state line, Route 15 soon intersects U.S. Route 20, much of which has already been widened and modernized by the Massachusetts highway department. That highway in turn connects with the superhighway between Worcester and Boston.

Unlike the Merritt Parkway, from which trucks and commercial vehicles are barred, the Wilbur Cross Parkway north of Meriden will be unrestricted as to use because it is not paralleled by a main highway open to commercial traffic as is the case with the Merritt Parkway. No decision has been reached as to the extent to which access to the parkway will be restricted, but wherever the highway is being built on a new location a right-of-way from 300 to 400 ft. wide is being acquired in order to discourage encroachment. All intersections with major highways are separated.

The position of the roads in the parkway and the width of shoulders and median zones vary, depending on whether an existing highway is taken over for reconstruction as a dual highway or whether a new location is adopted, but generally the plan consists of two 22-ft. concrete roadways separated by a median zone 20 ft. wide. Shoulders are of surface-treated gravel, widths ranging from 9 to 12 ft.

Construction at the east end

A little over 9 miles of grading for what ultimately will be the westerly, or southbound, roadway for the parkway south of the Massachusetts line was completed in 1939, all culverts and underdrains being installed at that time and guardrail posts being set. A gravel base course also was laid, 22 in. deep in rock cuts, 10 in. in earth cuts, and 5 in. deep on fills when required.

As previously noted, about half the newly graded road was given a light bituminous surface treatment so that it could be put into service before the permanent paving was laid. It was then expected that the completed road would have 9-ft. shoulders on the west side, which would be permanent, and 10-ft. shoulders on the east side, where gutters and the median zone ultimately would be built; but because of the call for wide shoulders that was made last year to facilitate the movement of defense forces, the plan was changed. Shoulders on the west side now are being widened to 10 ft. and on the east side to 12 ft.

The new section south of the Massachusetts line has a 400-ft. right-of-way. Grading, generally, is for only the southbound roadway, but some cuts were taken out to the full width where borrow was needed for the fills. Underdrains parallel to the road and 16 ft. from the centerline were laid through all cuts, bituminous-coated perforated corrugated pipe, 8 in. in diameter, being used. These were provided with manholes at frequent intervals to facilitate inspection and cleaning, manholes being formed with large-diameter pipe of the same material.

In preparing the 4.3-mile surface-treated section for permanent paving, the surface was scarified and from

Fig. 4. To meet military requirements, shoulders on the highway are being widened to 10 ft. on the westerly side and 12 ft. on the easterly side, which ultimately will be the median zone of the dual highway. In the distance is the contractor's batching plant set up in a cut that was taken out for the full width of the completed parkway.

3 to 4 in. of the loosened material was bladed off across the shoulders. Where this was not sufficient to meet the requirements for the widened shoulders, new material was brought in as part of the paving contract. Some resetting of the wooden guard-rail posts also was required.

Concrete paving

Concrete paving now being laid is in two 11-ft.-wide lanes having a uniform thickness of 8 in. Temperature reinforcing is placed 2½ in. below the surface. Expansion joints are spaced at intervals of 73.33 ft. The longitudinal construction joint is of tongue-and-groove design with ½-in. dowel bars spaced generally at 30-in. intervals, but none is nearer than 6 in. to the expansion joint.

The type of expansion joint is notable. It is one developed by the highway department to provide a joint that will stand the rough treatment involved in being set in stiff concrete without displacement. It is an adaptation of the Olmstead patented load-transfer device (in which dowel bars are encased in a bituminous-filled metal sheath at one end and left free to be seized in the concrete at the other, the free end being alternated) and a metal-sheathed premolded bituminous expansion joint filler, the whole being welded into a rigid unit. During the concreting operations, fresh concrete for the area

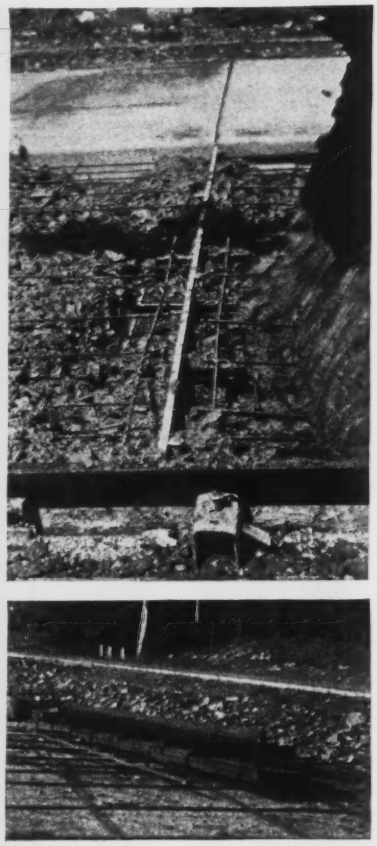


Fig. 5. Expansion joints used in the new pavement are rugged and not easily displaced during concreting. They are a combination of two commercial products that has been developed by the state highway department.

below the reinforcing mesh is dumped on each side of the joint position, the joint assembly is set and three of the heavy spikes used for the steel forms are driven behind it to support it against the shove of the screed. Its top is covered with a steel channel slipped down over the filler and concrete is worked in around the joint before the screed comes along. After the first pass of the screed over the top concrete, the spikes are pulled. Form finishers lift off the protective channel before the final finishing operations. A poured joint filler completes the job.

Concrete

Crushed trap rock for the concrete aggregate in two sizes, ¾ in. and 1½ in., is trucked to the job from Farmington, Conn., about 50 miles, and washed sand comes about 30 miles from Manchester, Conn. The contractor's batching plant is located in a cut at about the middle of the job with stockpiles against the slope where trucks can dump from the top of the bank. Bulldozers are used to spread the stone and sand in the stockpiles, and from the stockpiles a clamshell bucket delivers the aggregate to batching bins set up close to the highway. Cement also is trucked in bulk from the railroad yard at Stafford Springs and is dumped into a batching bin set in advance of the aggregate batchers so that the batch

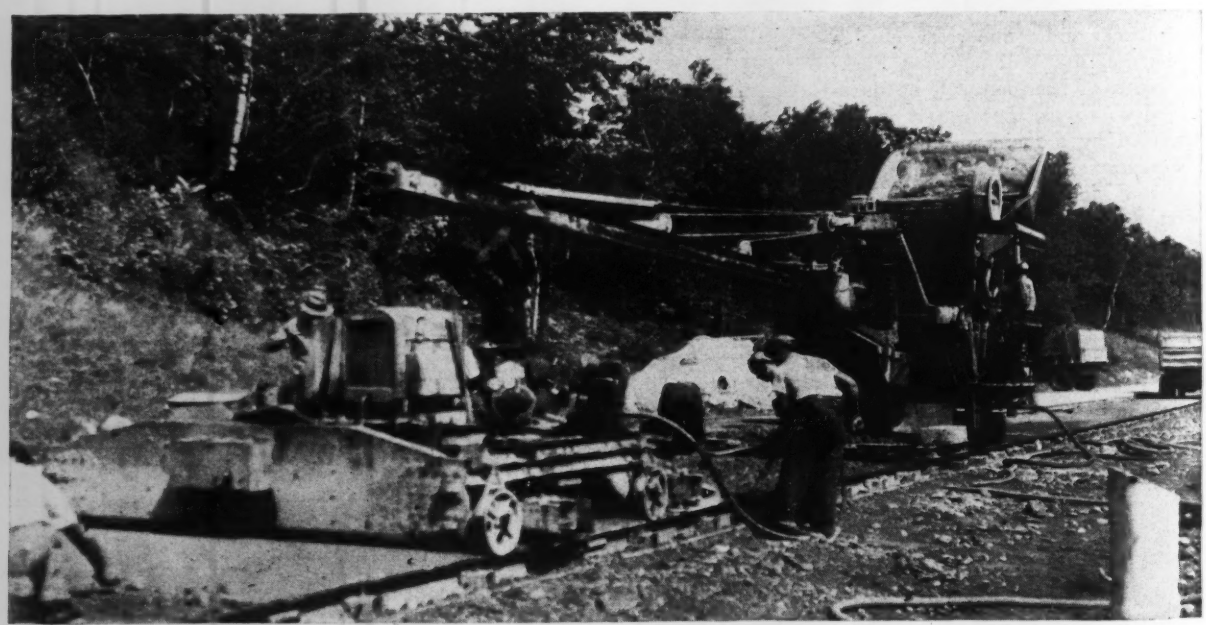


Fig. 6. One 27-E paver and two finishers are used, the transverse finisher working close behind the paver and the longitudinal finisher at some distance behind. A vibrator is used on the transverse screed at the first pass, but not thereafter. Hand vibrators are used along the forms.

trucks pass from one to the other on their way to the paver.

A 27-E paver is used, concrete being placed in two layers, one 5½ in. deep below the reinforcing and a top layer of 2½ in. placed soon enough to avoid a construction joint. The screed and transverse finisher follow immediately behind the paver and the longitudinal finisher follows at some distance. A vibrator is used on the transverse screed during the first pass only. Hand vibrators are used to get concrete into corners and against the steel forms. Behind the longitudinal finisher, hand finishers do the final touching up and broom the concrete surface. The surface then is covered with cotton and burlap mats, which are wet and kept on and wet for a minimum of 72 hours.

The concrete mix is 1:2:4, which is slightly richer than the Connecticut highway department has used heretofore. A slump of from 1 to 1½ in. is specified, but the mix is not made too stiff to be workable.

Test beams, 6x6x30 in. long, are cast, two each day, and the highway department's laboratory trucks visit the job frequently to make test breaks. A modulus of rupture of 600 psi. is required, before traffic is allowed on the concrete, usually about five days. After completion of the job cores are to be taken at intervals of about 500 ft. in each lane.

Contractors and engineers

The contractor on the work described herein, about 4½ miles at the Massachusetts state line, is Onegilia & Gervasini of Torrington, Conn. That firm is carrying on its work with a single 10-hour shift, about 20 sections 73.3 ft. long being poured in a day, or about one section each half hour. Paving an adjoining section to the south of about the same length now is under way, the contractor being D. V. Frione of New Haven. A contract for paving an additional five miles will be advertised soon.

Construction of the project is under the general direction of William J. Cox, commissioner, Connecticut highway department. M. A. Tyack is engineer of contracts and construction. Walter M. Jones is resident engineer of the district in which the concrete operations are under way. N. E. Lown is engineer for the concrete paving job at the north end and C. R. Carpenter is engineer on the Frione contract.

What Charge for Fire Protection?

Charles H. Capen

Engineer, North Jersey District Water Supply Commission
Wanaque, N. J.

***Contents in Brief**—A water system must be designed to serve domestic and industrial needs as well as emergency requirements for fire protection. Knowing the relative value of a system, how much of the total cost of a system may be allocated to fire protection, and what revenue should be obtained for supplying this service? These questions are answered in the following analysis of fire insurance ratings, distribution system capacities, and population density.*

EVERY WATERWORKS MAN knows that his system must be equal to normal domestic and industrial demands, otherwise the consumers would soon see to it that he was replaced. Secretly, however, he hopes that the extreme test of a great conflagration or other emergency will never have to be met. How can he tell whether or not his system is "in line" with others, what charges, if any, should be made for fire protection service, and how much should be allotted to improvements of this nature? These are some of the questions considered herein.

Fire insurance rates—usually the only yardstick available—represent a vast amount of careful and painstaking study. But few engineers and superintendents have access to such data. Furthermore, these rates are just as dependent on the condition and availability of fire-fighting equipment as on water supply facilities, and it may be that a new piece of fire apparatus is needed instead of a 10-inch line on Main Street in order to obtain a better rate. City fathers respect a forceful argument on these matters if it is backed up by adequate figures.

Proportional cost

Studies made many years ago showed that in very large cities the actual cost of that part of the system installed for fire protection only amounted to 30 percent of the total cost of physical plant, while in small towns it reached as high as 70 percent. Most evidence is to the effect that there has been little change in these ratios. From the standpoint of operating costs, however, the picture is materially different. Nevertheless it is probably safe to say that not a single system in the United States charges a truly adequate amount for fire protection service. The result is that John Q. Citizen foots the cost in his regular water bill—instead of in taxes—and again it is a case of "soak the poor."

One of the most favored methods used in charging for fire protection service is the so-called "inch-foot and hydrant" charge initiated more than twenty years ago by the New Jersey Board of Public Utility Commissioners. In this the total annual charge to be levied was determined and while this was probably as much as the traffic would bear, it could not be considered fully adequate. From this total was deducted a charge for each hydrant (usually about $10 per annum) and the balance was divided by the number of inch-foot units to obtain a proper charge for each such unit. (Note: A main 8 in. in dia. and 100 ft. long would have 800 inch-foot units.) When additional mains are laid, the same unit charge is levied.

A more proper charge

The writer maintains that a more proper method would be to charge on the basis of "inch-square-foot" units because the capacity of pipelines varies more nearly as the square of the diameter. Thus the 8-in. pipe 100 ft. long would contain 6,400 inch-square-foot units. The balance of this paper will be devoted largely to pointing out how these readily determinable figures may be used in comparing distribution systems. To simplify this discussion, inch-foot and inch-square-foot will be termed I.F. and I.S.F., respectively.

Correlation of such units of measurement directly to population or area of a community cannot readily be made. Considerable study has indicated that a water system grows rapidly at first and then tends to taper

off in growth when the population approaches a degree of normal saturation. This suggests a relationship with density of population, and curves plotted on this basis indicate a definite trend. Taking D as the density of population in thousands per square mile, it was found by the writer several years ago that an approximate relation of I.F. units to density of population could be expressed by the equation:

$$\text{I. F. units per capita} = \frac{170}{\sqrt{D}}$$

Recently, in the course of a study of methods to interconnect water systems in northeastern New Jersey, the values of I.F. and I.S.F. units were again computed for more than 150 municipalities. Some of these were eliminated from the final comparison because of factors tending to make their use illogical, but altogether 129 terms were inserted in a tabulation for computation by least squares and the following equations were obtained:

$$\text{I. F. units per capita} = \frac{168.9}{D^{0.509}} \quad (2)$$

$$\text{I. S. F. units per capita} = \frac{1128.6}{D^{0.3406}} \quad (3)$$

$$\text{Hydrants per thousand population} = \frac{28.76}{D^{0.3370}} \quad (4)$$

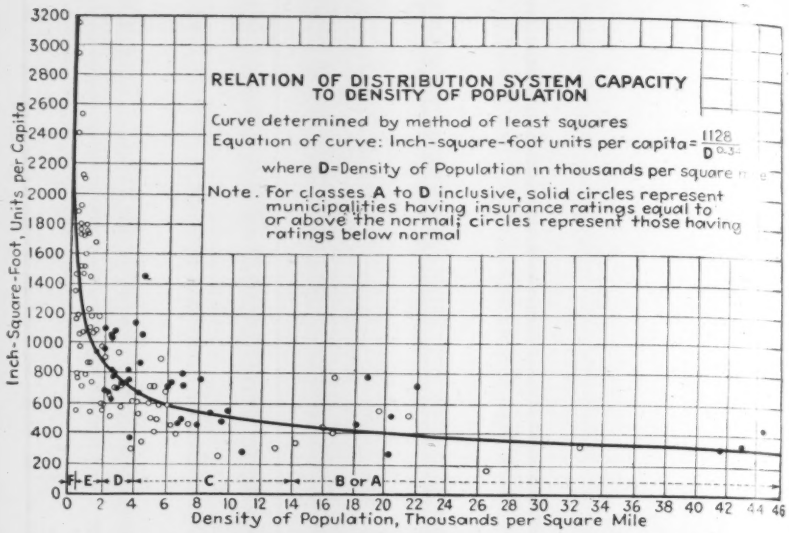
Equation (2) virtually gives the same results as (1) and for all practical purposes (1) can be used. Similarly (3) and (4) may be simplified as follows:

$$\text{I. S. F. units per capita} = \frac{1125}{\sqrt[3]{D}} \quad (5)$$

$$\text{Hydrants per thousand population} = \frac{28}{\sqrt[3]{D}} \quad (6)$$

Making the comparison

It will be found that equations (5) and (6) are quite helpful in comparing systems of various cities. One caution must be exercised in the use of (5), however, to the extent that transmission main facilities should be omitted in order to obtain a true picture of conditions. It is realized, of course, that it is sometimes difficult to draw the dividing line between distribution and transmission. All that can be given is a general rule to the effect that transmission mains are those used essentially for the transporting of supply in bulk outside municipal boundary limits. Ordinarily, all mains within boundaries are considered part of the distribution system unless (a) they are used in some measure to supply other municipalities, or (b) they have no take-offs for distribution purposes, or (c) they are wholly used for connecting one source of supply with another source of supply.


RELATION OF DISTRIBUTION SYSTEM CAPACITY TO DENSITY OF POPULATION
Curve determined by method of least squares
Equation of curve: Inch-square-foot units per capita = 1128 / D^0.34
where D=Density of Population in thousands per square mile
Note. For classes A to D inclusive, solid circles represent municipalities having insurance ratings equal to or above the normal; circles represent those having ratings below normal
Inch-Square-Foot Units per Capita
Density of Population, Thousands per Square Mile
F
E
D
C
B or A

Relation of distribution system capacity to density of population.

In the cut are plotted the points for which I.S.F. units have been computed, as well as the curve represented by equation (3). On a copy of this chart there was written, adjacent to each plotted point, the insurance class or rating for each municipality as established by the National Board of Fire Underwriters or the Schedule Rating Office. Then approximate groupings by classes were considered and as a result new ranges were proposed as shown in Table I.

The areas on the graph included in these various established ranges are shown with corresponding letters on the curve.

It would be expected that if all systems conformed exactly to this method of rating, municipalities represented by points found above the line would have ratings equal to or higher than the average. Conversely, those below the line would be lower than average in rating. Of course, no such arbitrary classification can be exact, but the following observations from a study of Fig. 1 will serve to show to what extent the assumptions are justified.

The value of this method is brought out by making solid those circles representing systems having ratings higher than average and leaving hollow those lower than average. A summary of the groupings with respect to their ratings and relation to the computed curve is given in Table 2. Classes A, B and C show a marked conformance to the standard, while Class D is not so marked. Ratings below D are irregular and no comparison or classification is justified. Use has been made of all the points plotted, however, in determining the equation of the curve.

The matter of charging for fire protection service is, or should be, rather closely related to the question of rating. Nevertheless, the two items are usually considered on a totally different basis. Only the most courageous individual would venture to suggest charging for such services on the basis of true cost. Instead of reaching a value of 25 to 50 percent of the total revenue, in actual practice such charges seldom exceed 15 per cent and are often materially less or absent entirely.

TABLE I—SUGGESTED AVERAGE FIRE INSURANCE RATINGS FOR VARIOUS POPULATION DENSITIES

Insurance Rating	Density of population (Thousands per square mile)
A* and B	14 or greater
C	4 to 14
D	2 to 4
E and F	0 to 2

* Note: Class A is highest rating, i.e. lowest premium.

Allocation of charges

As a result of considerable time devoted to a study of the situation,

TABLE II—ACTUAL INSURANCE CLASSIFICATIONS
of municipal water systems as related to the assumed standard of rating

Insurance class rating	Total points plotted	Points above curve: Total	Points above curve: Normal rating or higher •	Points above curve: Rating below normal †	Points below curve: Total	Points below curve: Normal rating or higher •	Points below curve: Rating below normal †	% Conforming to assumed standard
A&B	16	11	8	3	5	1	4	75
C	35	17	14	3	18	5	13	77
D	26	12	10	2	14	8	6	62
	77	40	32	8	37	14	23	71

• Shown solid. † Shown in outline.

there is suggested the following allocation of charges for protection service:

Item	Per cent of total fire protection charge: For a supply to one municipality	For a supply to more than one municipality
I. S. F. units	90	65
Hydrants	10	10
Population	..	25
	100	100

The advantage of such an arrangement is that even in a single municipality or area, extensions immediately begin to yield some revenue regardless of whether or not additional consumers are obtained. An adjustment of rates easily might be made at the time of each federal census.

As an example, let us take the true case of a municipality that in the early 1920's had a population of about 30,000 and a fixed water capital of about $3,000,000. This represented an investment of about $100 per capita, and normal returns in those days were about $6 per capita, so apparently the water department was on a reasonable footing. Vast industrial expansions began and visionary civic leaders planned a golden future. Before 1930, fixed water capital exceeded $7,000,000 and population ran just over 40,000. Water department receipts were around $300,000 annually. Obviously something had to be done. The water engineer recommended an inch-foot charge, particularly since the I.F. units had been increased more than 200 percent.

The total of these units was found to be about 3,000,000. On the basis of the rate for such units in use in nearby municipalities, i.e., one cent annually per unit, the revenue from this source would be $30,000 for I.F. units. To this would be added $10 for each of the 500 hydrants or $5,000 annually, the total being $35,000. True, this amount would have by no means solved the headaches attendant to this particular case, but it would have aided materially.

The mayor argued that it would be merely taking money out of one pocket and placing it in another. He further refused to have anything to do with the proposition unless the water department rid itself of all but vitally necessary employees. Since it was practically impossible to do this, the gesture meant little.

Actually it was computed that $60,000 to $90,000 would be an equitable total, the latter value being closest to a true figure. Since the I.S.F. units totalled 60,000,000 the division of costs given in the preceding table would show 90 percent of $90,000, or $81,000 allotted to I.S.F. units and $9,000 to hydrants. The unit charge would then be $0.0015 or 1.5 mills per I.S.F. unit per annum, while the charge per hydrant would be $15 per year. As it is now, an amount far greater than $90,000 has to be placed in the annual tax budget to meet the deficit in the water department.

Finally, if more than one municipality is involved, the levy of 25 percent of the total on the basis of population merely assures a reasonable return corresponding to the risk encountered without respect to size of mains.

The purpose of this paper is to furnish a yardstick by which men in charge of water systems may improve both service and revenue. If this end is accomplished, then the tedious work involved in making up the material for chart on opposite page will have been amply repaid.

Court Holds Cancellation Of Contract Unwarranted

THE DISTRICT COURT of Puerto Rico, in the case of Rexach *vs* The Arundel Corporation and others, held cancellation of a subcontract held by Rexach to have been unwarranted but awarded no damages due to the conditions under which the cancellation occurred. The court's decision was in line with fairly well-established rules in like cases in this country. The following summary of the decision was prepared by George R. Shields of King & King, Washington, D. C.

F. B. Rexach was the subcontractor of the principal contractors for the building of the new air station near San Juan. His undertaking was to dredge certain quantities of material from one specified shoal and other quantities from two other shoals as required, at a price which was evidently lower than the actual cost. Borings had been made over the site of the work and the materials were represented as being thus and so. His dredging equipment was inspected and found suitable, although it was later found that it was not capable of dredging to the required depth. He also encountered materials radically different from those described, and because of these circumstances failed to make a rate of progress during the first two months of operations that would insure completion of the work within the time agreed. Thereupon the principal contractors, with the approval of government officers, cancelled Rexach's contract and let the work to another dredging contractor at a substantially higher price. Rexach was paid 90 percent of the earnings during the first month of operations but was not paid any part of the moneys thereafter earned. He sued for the balance thus earned and for damages resulting from the cancellation.

The court held that the cancellation was unwarranted, but inasmuch as Rexach had a losing contract his claim for damages was denied. He was given a judgment for the unpaid earnings under the contract.

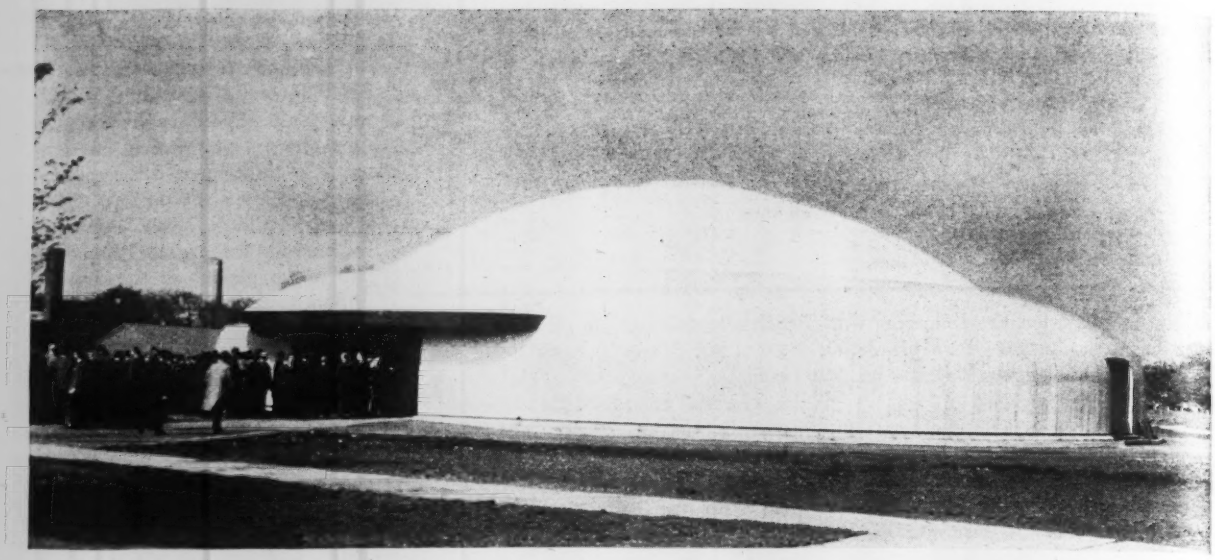


Fig. 1. Windowless building of welded thin steel plate with 80-ft. unsupported dome roof.

Steel-Plate Dome Building

***Contents in Brief**—An elliptical steel-plate dome, resting on a vertical steel-plate side wall, forms the main circular room, 80 ft. in diameter, of a new employees' restaurant and recreation building at the Chicago Bridge & Iron Co. plant in Chicago. A low, annular "lean-to," also of steel plate, surrounding the main room, houses heating and air conditioning plants, kitchen, storerooms and lounges. Interior finish is largely insulation and acoustical material sprayed on the plates.*

BUILDING STEEL TANKS is the chief business of the Chicago Bridge & Iron Co. Therefore, when the need arose recently for new facilities for employees' dining and recreation activities, the company simply built another steel tank in its front yard, resulting in a most unusual and interesting building structure. It can be considered either as a building built like a tank or as a tank adapted as a building. The final result is an insulated, air-conditioned, full artificially lighted, clear-span circular room, 80 ft. in diameter, with an elliptical dome combined ceiling and roof, surrounded by a low, annular steel-plate "lean-to" that houses mechanical equipment, the kitchen, store rooms and cloakrooms.

Company officials refuse to take the structure seriously. As George T. Horton, president, expressed it: "We built it for our own amusement, for the pleasure of our employees and friends, with no commercial thought in mind. Also to demonstrate that thin steel plates are satisfactory for self-supporting dome roofs of wide span."

Welded steel-plate dome

The main building consists of a steel dome of 80 ft. span, 20-ft. 3½-in. rise, built up of preformed dished sections of $\frac{3}{16}$-in. steel plate, all butt-welded. This dome rests on a cylindrical straight-side wall, 8 ft. high, of ¼-in. plate, which gives a clear height at center of dome of 28 ft. 3½ in. The ¼-in. plate was selected for the side wall only because $\frac{3}{16}$-in. plate was not obtainable in sufficient width to eliminate circumferential joints. No stiffening rings are required in the dome structure, all ring stresses are taken by the welded plate.

Attached to, and completely surrounding the center circular room, is an annular "lean-to", 14 ft. wide, with a domed roof and vertical outside wall 5 ft. 3 in. high, all fabricated of $\frac{3}{16}$-in. welded plate. The roof of this annular structure intersects the main dome 15 ft. 3 in. above the floor. Because of the flatness of the roof of the outer structure, light stiffeners were welded to the under side.

The annular space of the lean-to is divided into compartments of various lengths by steel diaphragm partitions. These compartments house the kitchen, mechanical equipment, boilers, cloak and rest rooms, a lounge, and storage rooms. Facing the street and plant office building is a wide vestibule protected by a steel canopy, with inner and outer doors that form the main entrance. The outside wall is cut at four other points by service doors. Besides the main entrance, there are five sets of doors between inner and outer structures.

The combined structure rests on two concentric concrete ring footings, one under each vertical wall. Combined with the outer footing is a concrete gutter for drainage. The two shells are welded to 3x3-in. ring angles fastened to the concrete footings by anchor bolts.

The inner room is fully air condi-

tioned, heated and cooled through the air conditioning system. The main air duct, of steel plate, runs around the outside of the center room, just below the lean-to roof, and air is discharged into the main room through louvre vents in the dome plates. Return air passes through grilles in the side wall at the air conditioning plant. Rest rooms, lounge and kitchen are ventilated by exhaust fans; conditioned air is drawn in from the main room through door grills. These outer rooms are also equipped with radiators for heating, and the kitchen has a unit heater in addition.

Insulation and acoustical treatment

The interior finish is both simple and practical. In the big room the dome is covered with a resilient compound that serves not only as insulation, but as an acoustical material and interior decorative finish as well. The compound is a fibrous material projected simultaneously with an atomized adhesive through a specially designed gun in such manner that the combination mixes in the air. Sprayed directly against the steel plate, the combined materials form a fiber mat built up, in this case, to a thickness of 2 in. For the final coat or layer, the materials were changed somewhat, to produce a soft, smooth, decorative white finish. The ceiling of the outer structure is covered with same fiber mat, finished with aluminum paint. All walls are covered with the sprayed mixture in denser form, about ½ in. thick, finished with plaster.

All exterior surfaces have been painted. The butt-welded joints leave a smooth, unbroken surface, giving the painted exterior an unusually attractive appearance.

Floors in both sections are reinforced-concrete slabs. In the large main room the slab is 5 in. thick, resting on concrete crosswalls 9 ft. c. to c. with an air space underneath. In the lean-to section the floor is an 8-in. slab spanning between shoulders cast into the concentric concrete ring footings. The floor of the big room is covered with asphalt tile. Some floors in the various outside rooms are finished with asphalt tile, others are covered with a resilient compound, still others are plain concrete.

Lighting

There is little or no precedent in lighting the interior of a structure the size and shape of the main room.

Fig. 2. Center falsework aided in erection of steel plates. Note ventilation duct surrounding inner room, held by light supports.

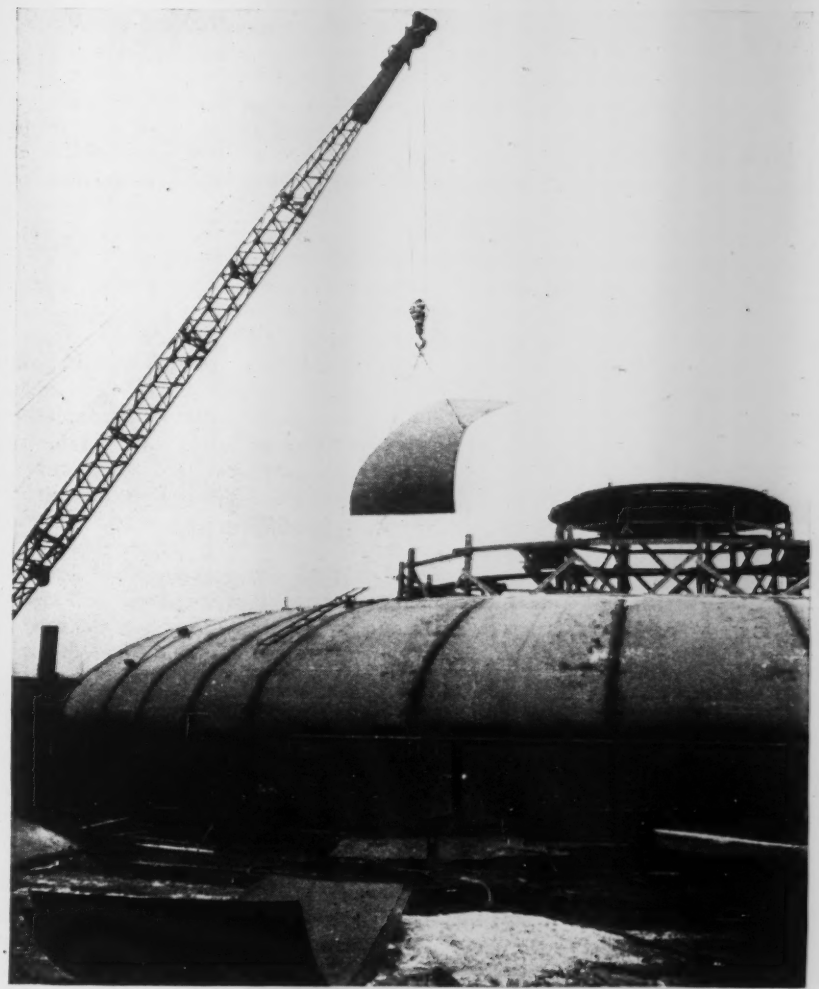


Fig. 3. Dome roof was fabricated from dished plate sections. Usually two shop-welded plates formed a field section, which was set and butt-welded.

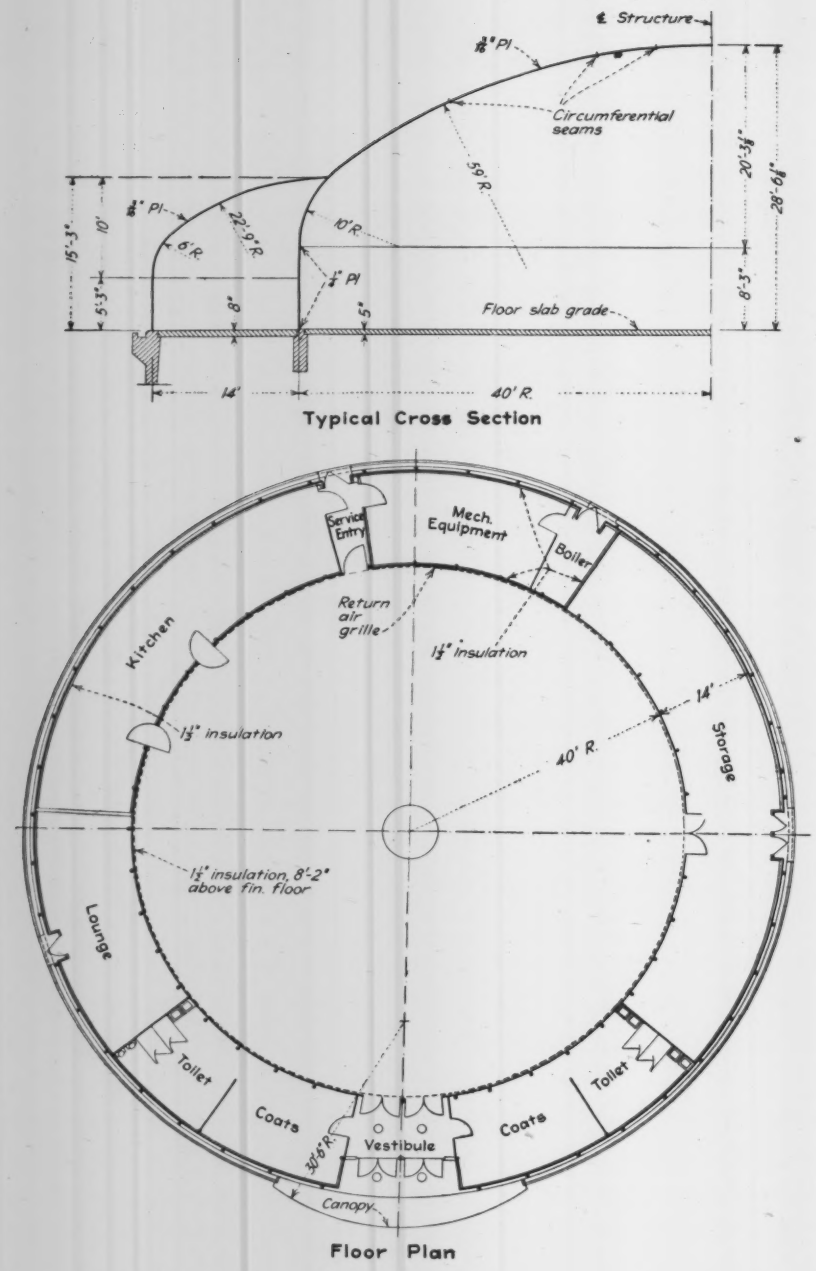


Fig. 4. Plan and section of the structure. The large self-supporting dome is carried on vertical plate sidewalls. Butt-welded joints leave a smooth exterior.

After trying various schemes, a simple dished circular reflector on a column in the center of the room proved most satisfactory. Light globes placed on top of this reflector are out of sight, yet give a satisfactory reflected light from the dome that is practically shadowless.

Erection

Designs were prepared by the company engineers in collaboration with Winston Elting, Chicago architect. The building was fabricated in the company's shops and erection was by company forces. After the ring foundation had been poured, the steel sidewalls were set up and welded in place. The dome plates were supported by falsework during assembly and field welding, after being lifted to place by crawler cranes. Field plate sections were made up of two shop-welded plates.

Oxygen Demand of Sulphite Waste Liquor

The initial or immediate oxygen demand of sulphite waste liquor when discharged into a natural waterway is a chemical demand upon the dissolved oxygen of the water by the free and loosely combined sulphur dioxide of the waste liquor. This instantaneous immediate demand is followed by a slower gradual biochemical demand of the easily oxidized organic matter such as sugars and then by the more slowly oxidized organic matter such as lignin.

The new concept of immediate or chemical oxygen demand was introduced into the study of sulphite waste liquor pollution by Irwin A. Pearl and Henry K. Benson, University of Washington, at a recent meeting of the American Chemical Society. This value has no relation to the well-known biochemical oxygen demand, which has been used heretofore in the study of waste liquor demands upon the oxygen of streams and natural waterways. The immediate oxygen demand is determined by treating a known volume of oxygen-saturated water with a known volume of waste liquor and immediately determining the dissolved oxygen content of the resulting solution. The difference between the dissolved oxygen content of the resulting solution and that of the original saturated water when corrected for volumes of solutions is a measure of the immediate oxygen demand.

It has been found that when sulphite waste liquor is discharged into seawater the immediate or chemical demand is the only oxygen demand of consequence. Once the chemical demand is satisfied, the slower biochemical demands can easily be satisfied by the seawater, due to its normal processes of extracting oxygen from the atmosphere and phytoorganisms. Because of this fact a search was made for a catalyst to make possible the oxidation of the oxidizable sulphur compounds in the waste liquor by air prior to its discharge into a waterway.

It was found that activated carbon was an effective catalyst for this reaction, and that a concentrated waste liquor treated with air in the presence of activated carbon could be given a dissolved oxygen content equal to or exceeding that usually found in natural waters.

Programming Highway Construction To Meet Post-Defense Needs

***Contents in Brief**—Addressing the American Association of State Highway Officials at its annual meeting in Detroit, October 1, Robert B. Brooks laid down for the association a program for highway work to create employment when the nation's defense activities are curtailed. Those parts of his paper that relate to the program are reproduced in the following.*

STATE HIGHWAY OFFICIALS and officials of the Public Roads Administration must plan now for what is to be done in the way of highway building when this present emergency is over if highway work is to play its full part in the post-war readjustment period, said Robert B. Brooks, consulting engineer, St. Louis, a member of the Missouri State Highway Commission, at the annual meeting of the American Association of State Highway Officials held in Detroit, Sept. 29–Oct. 2 (*ENR* Oct. 9, p. 53). Mr. Brooks took as his subject "Programming Highway Improvements—Present and Post-War," but centered most of his attention on planning the work to be undertaken in the post-war period to help take up the slack in employment created by termination of the defense effort. He concluded by outlining a definite program of study, which he recommended to the association for adoption. Given in the following are the principal sections of his address relating to that subject.

Looking toward post-war conditions, it will be mandatory that we not only program highway improvements but that we program them looking towards a full employment for both men and machines. In spite of obstacles, it is comparatively easy to organize society for national defense because we have a specific objective, *viz.*, to beat the Nazi idea. The specific requirements are tangible—blueprints, men and materials.

In peace time it is far more difficult to organize society towards the full employment of men and machines. How shall we employ our men and machines? What shall we produce? Where and in what quantities? Notional defense programming with its subsequent reaction only indicates our problems. This task is a post-war problem in which programming of highway improvements is to play a large part.

The President of the United States has repeatedly called attention to the present need of preparation for a post-war slump. He has indicated that he looks to an enlarged public-work program as the principal way of dealing with a post-war slump when it arrives. He has called on the National Resources Planning Board to suggest a six-year planned program of public works. The Public Work Reserve has recently been inaugurated as an organized effort by the Federal Works Agency to build up a group of desirable projects by the several states and local governments. It is my understanding that the Public Work Reserve is deferring its requests to the state and local officials for their recommendation of highway planning for future work until a coordinated planning program can be studied that will furnish at least a proposed skeleton of unified highways.

Business Week of Aug. 16, 1941, estimates that when men in the army, navy and air corps are released to private life, and the production of tanks, guns, planes and other war supplies is cut down, there will be a minimum post-war unemployment, assuming a July, 1937, level of business, of 8,500,000 men.

It is not conceivable that the citizens of the United States will be satisfied with any post-war economy in which poverty exists amid plenty, or in which men and machines are idle because the outlook is not sufficient to justify the venturing of private capital in putting unemployed to work. A public works program for post-war conditions must be set up. What is the basic objective of a public works program?

"In order to provide a 'shelf' or 'reservoir' of public construction projects of tested value, the National Resources Planning Board recommends:

1. Continued and invigorated efforts to secure the preparation of six-year programs or capital budgets by federal agencies, state governments, local governments, and other agencies, public and private, anticipating a large volume of construction activity.

2. Development of alternative list of projects included in six-year programs according to size of the project, types and locations of skilled and unskilled labor involved, materials needed, rapidity of beginning, and flexibility of termination.

3. Immediate inauguration of surveys, investigations, and preparation of engineering plans and specifications for selected projects through allocation of aids to federal and non-federal agencies from a revolving fund to be administered by the President through his executive office; and reimbursed to the revolving fund as part of the cost of construction of the project."

In view of the above, let us see how programming of highway improvements for post-war needs can fit into these recommendations. This program must take into consideration: A trunk system of highways to supply the major highway transportation needs of every state; a study of limited accessibility to the high-speed roads within that system; arterial highways into, through and around metropolitan areas, with their necessary terminal facilities; secondary and local roads; bridges and grade separations; and a financial plan, including the problem of toll roads.

The minimum trunk-line mileage of highways set up by the various states as necessary for immediate improvement because of traffic and safety conditions, as compiled by the American Association of State High-

way Officials, Jan. 1, 1940, shows as of that date that 58,857 miles in the United States should be rebuilt at an estimated cost of $1,737,101,000; that 26,326 miles should be widened at an estimated cost of $737,520,000; and that 21,377 miles should be relocated at an estimated cost of $1,026,008,000. This shows that the needed reconstruction of our main, principal or trunk line highways sums up to a total of 106,560 miles, at an estimated cost of $3,500,629,000.

You know that these costs as of Jan. 1, 1940, when translated into today's highway construction costs will not only be greater in dollars and cents because of the higher costs, but also because of the nearly 15 percent more travel use that is being made of the highways this year by motor vehicles than a year and a half ago.

Trunk highway system

The time has come for you as highway officials to prepare a program including plans and specifications for the rehabilitation and modernization of your trunk line system. This will give you an opportunity to take up the slack through using the brains and energy of those engineers whom you had scheduled to go on national defense highway work, which evidently will not require quite such strenuous efforts during the next several months.

The programming of post-war highway work must of necessity provide for any set of conditions that may prevail after the emergency period. Beginning at once, every opportunity should be used to create a reserve of work to be performed when, if and as we find it necessary to supply employment for the great number of men to be released by the discontinuance of defense operations after the emergency. The case in point seems to be with us now. It may be that a shortage of essential construction materials necessary for defense projects may result in a necessity for marking time in certain phases of highway work not required on defense and strategic work. Such a condition might easily result in having on your hands a surplus engineering personnel rather than the existing shortage. This sets up for you the opportunity to engage these men in preparatory work such as surveys, design, right-of-way acquisition, etc. It means that your trained men should not be released.

Many projects can be planned in such a way that the present desirable way of performing highway work, by contract, can be continued. Do not allow your highway organizations to deteriorate because of lack in intermediate national-defense highway work necessarily held up by lack of federal legislation. Preserve your present efficiency by using your entire organization, if necessary, in preparatory work.

The lessons you learned through the early days of WPA, CWA, FERA and the enormous waste of public funds during that period can never be forgotten. Certainly this should not be necessary in the future if your skilled highway organizations are maintained.

Our highways are planned on the basis of the greatest good to the greatest number. You know that our trunk system is the fundamental keystone in vehicular transportation.

A strategic highway system has been proposed by the War Department in collaboration with the Public Roads Administration and the states. Thomas H. MacDonald, Commissioner of Public Roads, in House Document 272 outlined a major system, and H. E. Hilts, assistant chief, division of highway transport, PRA, later on issued a report on an interregional system.

These proposed systems are made up of the most direct routes, between the major centers of population and the belts of heaviest population. In most cases they are already included in our state trunk systems. It may be well to combine these three systems, superimpose them upon our state trunk line systems and give them priority in design, construction or modernization, but it should be understood that these limited systems do not furnish the requirements of a state highway trunk transporation system as a whole.

Limited accessibility

As the volume of highway traffic increases on a limited mileage of main highways, highway officials realize that the express type of highway with limited-access roads is the only type of highway that provides an acceptable and desirable type of service. Let us keep in mind that this means highways free from marginal interference created by unrestricted roadside development and with major intersections eliminated by a separation of grade.

Major city traffic arteries necessarily carry the heaviest traffic [illegible] locations of greatest congestion, [illegible] tribute the largest amount of revenue and receive the least in return. They also are the most expensive highways to build, both in actual construction and in terms of rights-of-way land acquisition. Very often this land acquisition is just as expensive as the cost of constructing the highways.

A trend of collective opinion on traffic congestion in cities in metropolitan areas is towards the conclusion that a large percentage of vehicles using city streets have either their origin or destination in crowded sections and necessarily need terminal facilities just as all railroad passenger and freight trains need terminals and depots where they likewise unload passengers and freight when not in motion.

Secondary and local roads

While it is recognized that secondary and local roads do not pay their own way in the main, it is natural for a motor car owner who pays license fees and gasoline tax to feel that he is being imposed on when he is not given accessibility to a state trunk line.

Our problem then with local roads is to make a plan for the development of a local road system that will give good service to practically every household in the state. It can be assumed that if such a plan is properly developed a large mileage of these roads can be eliminated, making the problem of taking care of the balance so much easier for proper planning and future construction.

Highway bridges

Most of our citizens seem to feel that a bridge when once constructed will last forever and stand up under any kind of a load. The construction of new roads has been pushed, still using the old bridges. Many highway officials have felt that we should build the roads and then go back and build the bridges. You know that with the steadily increasing demand of traffic there has been very little money for bridge building. This results in narrow, obsolete bridges, some of which have been condemned and many restricted as to loads. We know that it is against the law to drive across the bridge with a load in excess of that for which the bridge is posted. There are few of you who believe that there

are many who pay very much attention to posted load restrictions.

Our American Association of State Highway Officials, as of Jan. 1, 1940, showed in the various states on our principal highways alone that there were 21,682 bridges which should be reconstructed or widened at an estimated cost of $444,476,000.

In addition to a study of bridges to be rebuilt or widened, toll bridges should be surveyed with a view ultimately to eliminate all tolls.

A financial plan

Charles M. Upham, executive director, American Road Builders' Association, made a statement several months ago to the effect that in order to modernize all of our highways it would take from 16 to 20 billions of dollars, and that this should be allocated over a ten-year period producing a construction program of two billion dollars a year.

While this figure of present needs and post-war programming is necessarily a flexible amount. the final estimate depends in large measure on what you highway officials find to be necessary, not only from a construction standpoint but also a work relief standpoint as a post-war measure.

You will recall that in the earlier stages of PWA 30 percent of the construction cost was provided by the federal government as a grant, which later on was increased to 45 percent. In WPA, federal aid was a larger percentage of the cost, taking care of most of the labor cost and a certain amount per man, per day for materials, with the sponsor contributing the balance. This established the principle that the federal government in addition to giving a portion of the funds for the public works project recognized the obligation of relief for unemployment.

It is recommended that in the post-war program that 35 percent of construction costs of highways and bridges be charged directly to work relief. The remaining two-thirds of the cost should be divided between the federal government and the individual states by an equitable formula such as is now in effect for federal aid, on a 50-50 basis or on a 75-25 basis, provided the Congress decides the latter is the more equitable arrangement.

In programming highway improvements for our post-war needs various economic influences have to be evaluated and relative values allocated to public works projects undertaken to sustain prosperity and to take care of the unemployment situation. Highway construction more nearly does this than any other work.

The utility of highways needs no comment. Highway construction lends itself more readily to rapid initiation, expansion or contraction at the most desirable times.

Highways can be constructed to any desirable degree or extent and do not require completion in their entirety to be of value such as is required by a sewage system, a housing project or a water supply. Highways can be planned in such a manner and to such a degree as to make the best possible use of available unemployed labor. They may be constructed from low-grade grading and drainage jobs to express highways serving congested metropolitan areas. This means that available materials as well as labor may be used. For every man employed directly in road construction there is more than one man supplying materials. Highways induce more investment and employment than any other single line of human endeavor.

It is estimated as of 1939 that one out of every seven persons gainfully employed in this country derives his living from the highway industry. It has also been figured that probably one-tenth of our national income is ascribable to this highway industry with its many ramifications.

While it has been estimated that highways can be built under the contract system for probably one-third less than under force account or other methods, the system is flexible so that on some types, where necessary, pure work relief can be used.

A definite program called for

It is recommended that the American Association of State Highway Officials allocate to proper committees for study the following subjects:

1. A trunk system of highways to supply the major highway transportation needs of every state.
2. A study of limited accessibility to the high-speed roads within that system.
3. Arterial highways into, through and around metropolitan areas, with their necessary terminal facilities.
4. Secondary and local roads.
5. Bridge facilities.
6. Grade separations.
7. Financial plan for the above, including the problem of toll roads.

It is further recommended that when these committees have prepared their post-war programming report the chairman and vice-chairman of each committee then function with the executive committee of the American Association of State Highway Officials and that there be quickly prepared an actual coordinated program of actual projects on which the various state highway departments may use any of their engineering personnel not now engaged on national defense work. This will not only keep together your trained organizations and prevent any "boon-doggling" when the post-war need actually is here, but will conserve the economics of our needs at that time and be of incalculable value to the entire nation.

Fire Tests of Partitions

Results of a series of recent fire-endurance tests of structural partitions of different types are reviewed in a report (BMS-71) of the National Bureau of Standards (obtainable from the Superintendent of Documents, Washington, D. C., 20c.).

Of 147 partitions, 78 were of wood or framed with wood studs and faced with wood, wood fiber, or gypsum boards, or with plasters applied on wood, gypsum, expanded metal or metal lath. Most of these were of the load-bearing type, and several were tested under working load while exposed to fire. The other partitions were of hollow or solid incombustible nonload-bearing types, most of which had steel frames with body or facings of gypsum or portland-cement plaster on metal lath.

Fire-resistance limits of the wood partitions, varying with the facing materials, ranged from 10 min. with ½-in. wood-fiber insulating boards on both sides, to two hours with 1-in. facings of neat wood-fibered gypsum plaster. With mineral-wool filled between the studs, the fire resistance was increased appreciably. As to the rise of temperature on the unexposed side, metal-framed hollow partitions differed little from wood-stud construction having the same facings, but the former remained longer as barriers to the spread of fire. For 2 to 2½-in. solid plaster partitions, the resistance varied from 20 min. with portland-cement sanded plaster or mortar, to 2½ hours with unsanded fibered gypsum plaster.

Roof Trusses of 300-ft. Span In Boeing Airplane Plant Addition

***Contents in Brief**—Manufacture of large bombing planes requires wide bays in the assembly line. Boeing's addition to plant No. 2 at Seattle is 1,100 ft. long and uses 300-ft. roof trusses. Trusses are of the Warren type and bottom chords have pin connections to supporting columns. At delivery end of building, an 80-ton door swings upwards, supported by the end truss, to give a clear opening of 35x295 ft.*

THE RECENTLY COMPLETED addition to plant No. 2 of the Boeing Aircraft Co. at Seattle puts another 22 acres under roof for the manufacture of large bombing planes. This new addition immediately adjoins the company's 15-acre plant described in *Engineering News-Record*, Oct. 24, 1940, p. 566, and, with incidental structures, brings the present plant area to about 42 acres. The new addition employs the same type of underground access tunnels, lockers and utility space, as well as many other features of the plant built last year. One new feature, however, is the increase of roof truss spans to 300 ft. to give greater width of clear floor space in the assembly bays. Production advances longitudinally of the bays, with materials coming in through the sides to be assembled into units and completed parts that advance lengthwise of the building until completed planes roll from the final assembly end.

The 300-ft. width was influenced by the available space and the need for making clear floor areas as wide as possible. The depth of the trusses had to be kept down to less than an economical figure by limitations that applied above as well as below. That is, it was desirable to have a 35-ft. clear height under the bottom chords and as the plant is adjacent to Seattle's principal airport, the building had to stay within a 60-ft. overall height limit. These limitations were particularly restrictive in the end truss which, in addition to carrying heavier loads than interior trusses, had to use a depth 2½ ft. less than the others by reason of the need for this much space for the door leaves when they are opened into a horizontal position above the doorway.

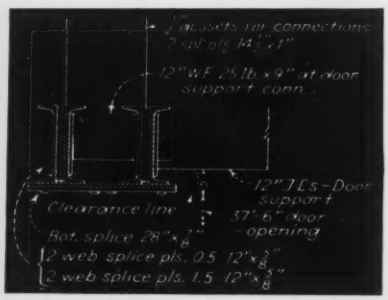

12" WF 25 lb x 9' at door support conn.
12" I Cs - Door support
Clearance line
37½" door opening
Bot. splice 28" x ⅞"
2 web splice pls. 05 12" x ⅝"
2 web splice pls. 1.5 12" x ⅝"

Fig. 1. Typical bottom chord panel connection for the 300-ft. door truss shown in the lower drawing.

The end truss therefore used heavier sections and its design was considerably affected by the special requirements of the door loads. The 300-ft. span is divided into twelve 21½-ft. panels and a 20-ft. 4-in. panel at either end. The door hangers, on the other hand, are spaced 20 ft. apart, which necessitated unsymmetrical subdivisions of the panels in order that the bottom chord could be tied in to other truss members on a 20-ft. spacing.

The door itself is of the canopy type in three sections, each 100 ft. long, and each made up of two leaves. Thus the horizontal projection into the building when the door is in its fully opened position is only one-half the height. Total weight put upon the supporting truss by the door is about 16 lb. per square foot of door area.

The construction program, applying the same methods to erection of intermediate and end trusses, was to set up temporary supports consisting of timber frames at the principal panel points, 43 ft. apart. Chords and intermediate members then were erected in the usual sequence. On this job it was found desirable to use two cranes to obtain better balance in handling the heavy members and to give speed and accuracy in their placement. The greater capacity of

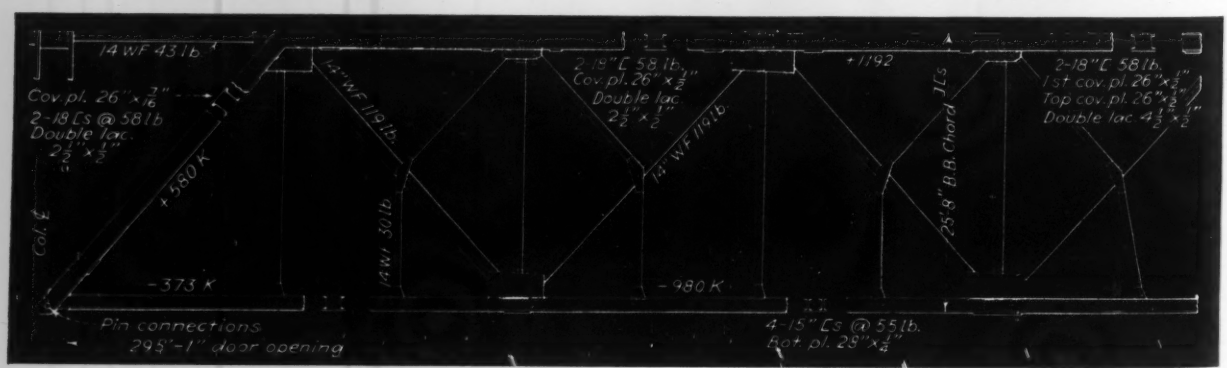


Fig. 2. A portion of the 300-ft. end truss, from which the 80-ton door is suspended. The door opening is 35x295 ft. clear.

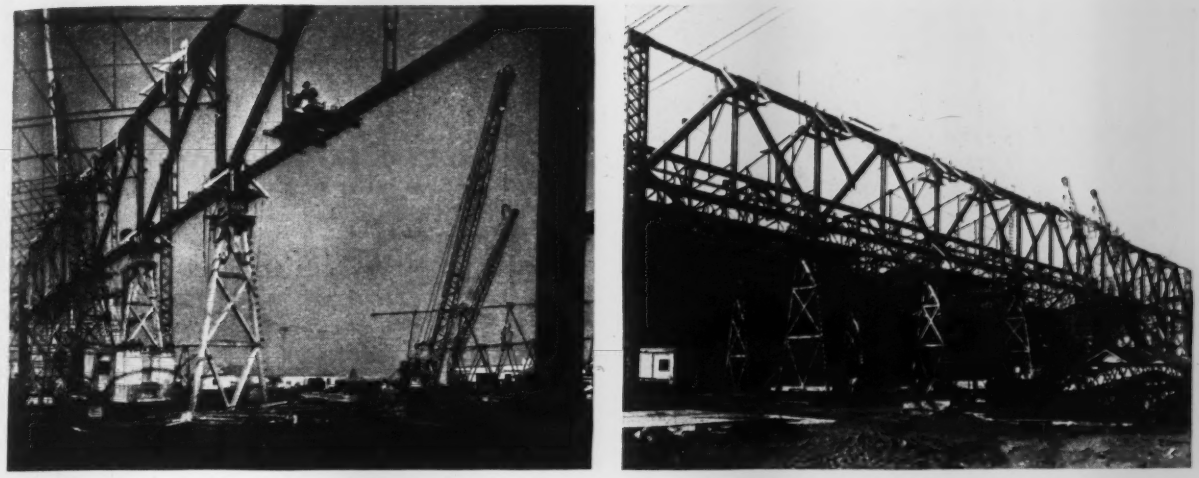


Fig. 3. Erecting a typical 300-ft. roof truss for addition to plant No. 2 of Boeing Aircraft Co. At right, the end truss (clear opening 35x295 ft.) carries an 80-ton door in addition to its share of roof and crane loads.

the two cranes was a particular advantage in making the first lift at each end of the truss where, because the design was such that assembly on the ground was more convenient, a 63-ft. length of the truss was set up bodily. With the two ends started in this way, the remainder of the truss was assembled a unit at a time, making final connection in the top chord at the center line.

The camber in the 300 ft. is 5 in. at the center, varying on the uniform curve of a parabola. The adjustment to this exact camber was taken care of with wedges and jacks on top of the A-frames. These were always set a little too high so that adjustments could be made by lowering rather than by raising, in bringing the truss precisely to the prescribed level.

All the trusses have pin connections where the bottom chords join the columns. The columns extend through to the top chord level but the horizontal member in the top chord end panel was not connected until temporary supports had been removed and the truss was carrying the dead load.

The 300-ft. trusses are 50 ft. apart and the light bracing trusses at right angles have inclined top chords to develop the saw-tooth roof. Crane rails slung from the bracing trusses are usually about 20 ft. apart and are designed for crane loads of 10 tons.

The addition to plant No. 2 was designed and built for the Boeing Aircraft Company by the The Austin Company, Richard Ellis, acting district manager, Northwest District, Seattle.

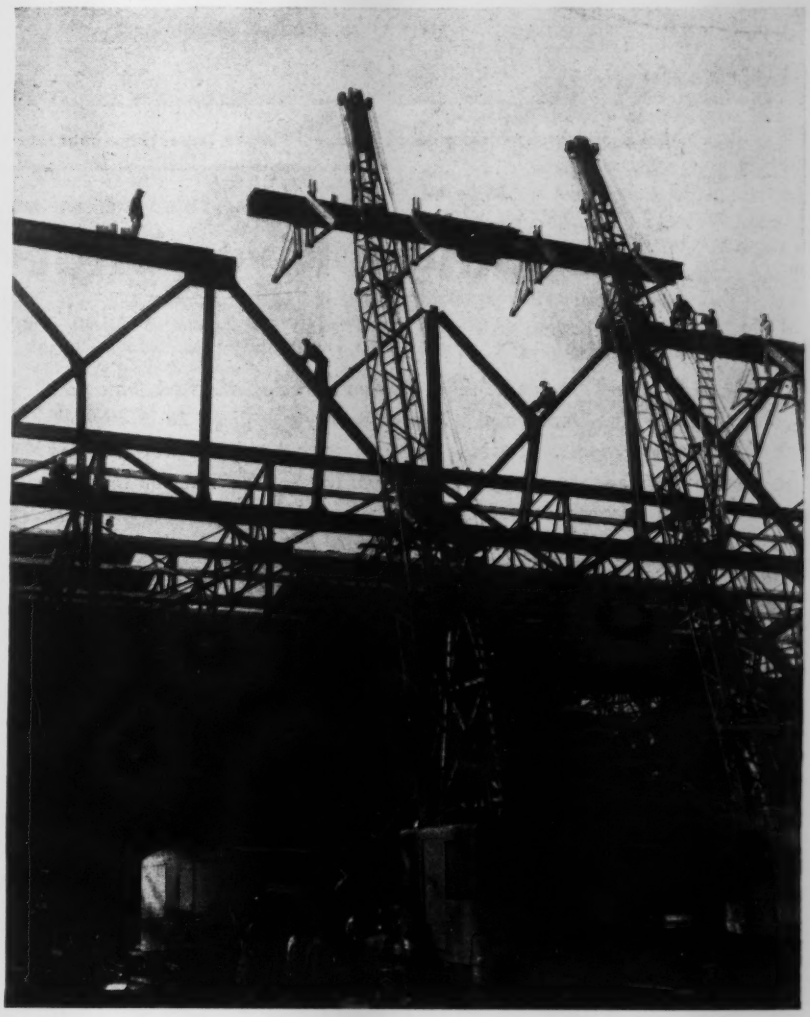


Fig. 4. Better balance and control was obtained by placing steel members with two derricks. The parabolic camber in the 300-ft. trusses was 5 in., introduced by wedges and jacks on top of the temporary timber A-frames. Initial elevations were always set high so that adjustment involved only lowering.

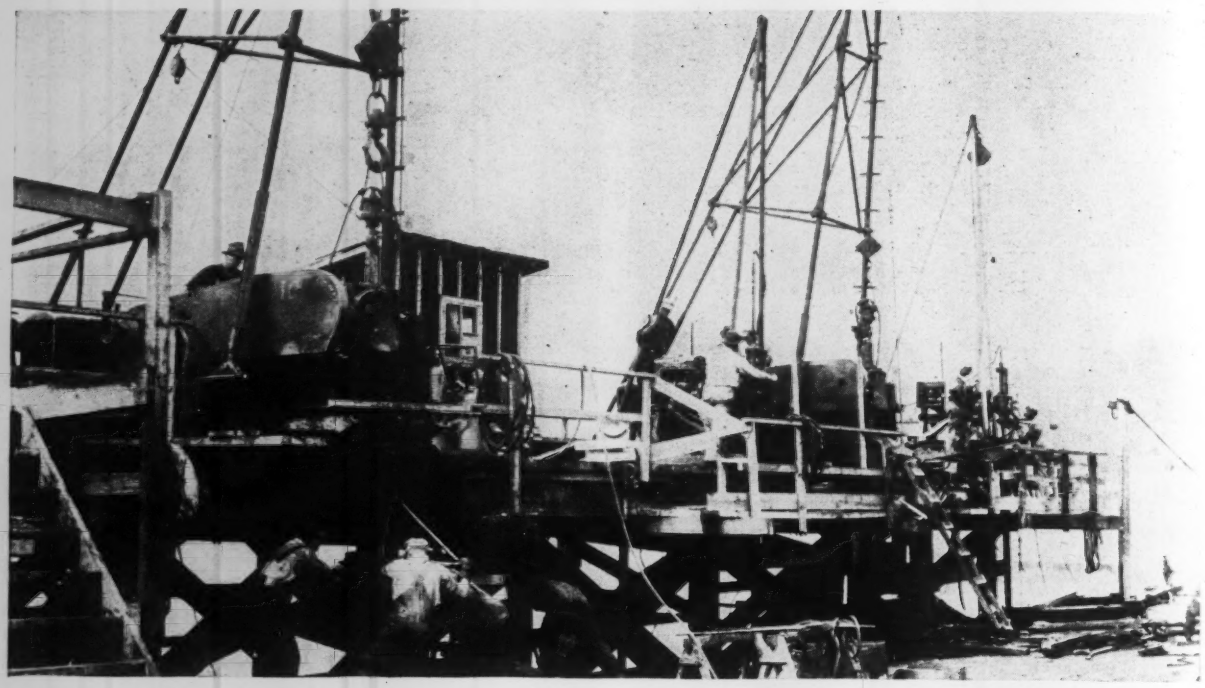


Fig. 1. Drills operating from a work bridge to make impervious concrete cutoff wall at Hales Bar Dam.

Stopping a River Under a Dam

***Contents in Brief**—TVA has devised a scheme to stop the flow, now 1,700 cfs., under Hales Bar Dam on the Tennessee River. First, 18-in.-diameter calyx drills remove cores, opening a trench to a maximum depth of 163 ft. below the water surface along the upstream face of the dam; an ingenious templet and exterior caisson guides the drill bits to keep the holes on line. Next, joined lengths of asbestos cement pipe are lowered into the core holes and filled with concrete. By lapping the holes a continuous curtain wall is provided. About 750 holes are expected to be required, extending from 25 ft. to 103 ft. below the river bottom.*

An Estimated Flow of 1,700 cfs. now passing under Hales Bar Dam, on the Tennessee River 33 river miles downstream from Chattanooga, justifies remedial work to conserve the water, and good engineering practice demands that the flow be stopped to assure the stability of the structure.

Difficulty has been experienced with the foundations of this dam since construction was started in 1905, and some flow under the structure has been apparent since shortly after it was placed in operation in 1914. Elaborate and varied schemes have been tried to stop the leakage but none has been successful although asphalt grouting, done in 1926, reduced the leakage substantially. Much of the asphalt has stayed in the old water passages, but new ones have opened up and the leakage is again serious.

The latest method adopted for sealing the flow under the dam involves calyx drilling of a series of vertical overlapping holes, parallel and as close as possible to the upstream face of the dam. Filled with concrete these holes form a cutoff wall extending from the rock surface, 55 to 60 ft. below normal reservoir level, to sound rock, in cases more than 100 ft. The maximum working depth so far encountered is 163 ft. A series of 18½-in.-dia. primary holes at 24-in. centers is first drilled and filled, followed by connecting holes drilled partly through the new concrete and slightly upstream to make the cutoff continuous. The work is expected to require from 30,000 to 40,000 lin. ft. of drilling. Supplementary cement grouting is being used to close smaller openings in the rock and is the only treatment required over large areas of the dam.

Hales Bar Dam was acquired by TVA in August, 1939, with other properties of the Tennessee Electric Power Co. Since that time a favorite avocation of TVA officials has been conjecturing ways and means to halt the underground river. The requirements of power and navigation, ruled out draining the pool even for investigation or preliminary work. A sheet-pile cofferdam of the cellular type could have been built upstream from the areas permitting leakage under the dam but it would have had to be very large to include the known intake holes and, because of intercon-

necting underground channels, it might have been impossible to dewater it. The calyx drill hole method was finally adopted as promising the best chance of success, since the continuous curtain wall so formed should stop flow through the horizontal fissures caused by washing out of shale beds and through the vertical openings resulting from the solution of calcites in the limestone.

Diamond drills for test and grout

First construction operation is the sinking of diamond drill holes (from a work bridge on the dam) to explore the rock and to admit grout when calyx drilling does not prove necessary. Holes are 3 in. in diameter and recovered cores about 1½ in. Initial drilling is on about 20-ft. centers. Where the material appears good, a cement grout, with a water-cement ratio varying from 0.5 to 1.0, and some calcium chloride added to speed setting, is pumped into each hole at several levels and at pressures up to 50 psi. Holes are then drilled at 10-ft. centers and grouted, and this is followed by holes at 5-ft. centers. It may be necessary to drill at 2-ft. 6-in. centers and at some points even closer to assure complete grouting.

Where the diamond drillings have revealed foundations above certain levels too poor to hold grout but reasonably tight below this point, grouting is done as high as it will hold and then the rest of the area is made watertight with a drilled cutoff wall. Where calyx drilling is required the area is dredged of silt and debris to expedite the start of the holes.

Calyx drilling operations

No precedent exists for drilling and sealing of the kind being used, so all procedures and methods are necessarily devised by trial and error. The scheme and equipment currently in use are described first, with some later reference to discarded methods.

Calyx drills, rated as being capable of removing 36-in.-dia. cores at 200-ft. depth, are operated from the work bridge as shown in Fig. 1. A structural steel templet, Fig. 6, to fix the location of the drilled holes is lowered to a point 6 ft. above the rock surface and held under water by lines although allowed to swing free. Then a 20-in. O.D. pipe, with joints made flush both inside and out and with the top extending above the water surface, is set through the end holes, plumbed and turned sufficiently, about 3 to 5 ft., into the solid underlying material to hold the templet steady and in position. The tops of the casings are held in place by rods and turnbuckles placed at 45 deg. with the work trestle, so close adjustment is possible in four directions. These two end casings are left in place while all the drilling is done through the one setting of the templet. After drilling the primary holes, the templet is shifted by turning end-for-end and sliding the templet down over the end casings in special guides provided in the templet, and the interlapping holes drilled exactly between and 8¾ in. upstream from the primary holes. The templet is then turned end-for-end again and shifted ahead, the end opening being put over one of the previously used flush-joint pipes to start another series of holes. A flush joint pipe is next put down in the outer end position and the cycle repeated.

The drilling operation is done first through the 20-in. O.D. flush joint casings at the ends of the templet and subsequently through 20-in. O.D. casing with heavy cast-iron faced flanges set temporarily into the intermediate openings in the templet and turned only a few inches into the rock to hold them rigid and make a seal with the rock. The drill bit used is made up of a core barrel of 18-in. O.D. pipe 14 ft. long and with ½-in. walls to which a 1½-in. thickness of hardened material is threaded to form the cutting edge. Drilling is done with chilled shot except where cavities are encountered when a bit to which tungsten carbide "bumps" have been welded is attached to the core barrel; these tungsten bits are equipped with slots so that shot can be added and drilling continued after the opening is passed and the bumps wear down.

Cores up to 12 ft. long are recovered without difficulty, pea gravel poured into the drill rod being used to break the core loose and hold it in the barrel for removal from the hole.

BRIEF HISTORY OF HALES BAR DAM ON THE TENNESSEE RIVER

The history of Hales Bar Dam has been filled with delays, difficulties, and unexpected expense, all resulting from the foundation material whose poor condition was not known until a large part of the work was under construction. The Chattanooga and Tennessee River Power Co., organized for construction of a hydro-electric project near Chattanooga, selected the site in 1904 and actual construction started late in 1905 under a $3,000,000 contract, which was to include a transmission line into Chattanooga. The structure contemplated consisted of a 60x312 ft. lock on the west side of the river, a 1200 ft. long and 65 ft. high gravity section dam with 11 ft. 6 in. crest and a powerhouse and transformer structure on the east bank. Lock construction proceeded satisfactorily but in the powerhouse and spillway areas great difficulty developed. Cofferdams could not be pumped out, three successive contractors failed and the structure was finally completed by an engineering firm for the owner's account.

Badly broken and seamy rock was found under much of the site. Extensive portland cement grouting was successful in some areas but not in others, which were subsequently sealed by sinking 26 pneumatic caissons ranging in size up to 72x54 ft. Further grouting was believed to seal all openings, and it is possible that it did but the differential head subsequently washed out channels, and considerable flow developed under the dam.

Both known fact and legend attach to the attempts made to close off the flow under Hales Bar. Inlets were located and filled with rock then covered with a clay blanket, but new passages were found by the water. Concrete was lowered in bags, barge loads of cotton, mattresses, bed springs, and almost everything of size and weight have been dumped into the Tennessee to fill the holes and stop the flow, all without success.

Most extensive of remedial construction was done in 1925-26 when Geo. W. Christians of Chattanooga succeeded in halting some of the leakage by drilling holes into the rock below the dam, (drills were operated in the inspection tunnel) and forcing asphalt, kept in plastic condition by heating with an electric wire, into the crevices. The drilling now being done shows the asphalt grouting was partly successful in sealing leaks but that new channels have opened up which completely nullify the grouting.

In 1939 Hales Bar Dam was acquired by the Tennessee Valley Authority, with other properties of the Tennessee Electric Power Co.

Major technical articles which trace the history and construction story of Hales Bar Dam are listed below:

The Hydraulic Plant of the Chattanooga and Tennessee River Power Co. *Eng. Rec.* Nov. 4, 1905, p. 516

The Chattanooga & Tennessee River Power Co.'s Plant. . *Eng. Rec.* Dec. 7, 1907, p. 621

The Tennessee River Power Development at Hales Bar. . *Eng. Rec.* Apr. 3, 1909, p. 470

Grouting Porous Foundations of Dam *Eng. News* Dec. 21, 1911, p. 754

Foundations for Hales Bar Dam *Eng. Rec.* Feb. 15, 1913, p. 178

Rock Grouting and Caisson Sinking *Eng. News* Nov. 13, 1913, p. 949

Asphalt Grouting to Eliminate Seepage *ENR*, May 20, 1926, p. 798

Cores are removed to the full depth of bad rock. The drill is then shifted and the operation repeated at the fixed 24-in. spacing of the templet.

Drawing three circles to scale will show that adjacent holes must not drift more than a total of 3 in. out of parallel position or the interlapping holes will fail to maintain concrete contact. To secure this accuracy in holes 100 ft. deep, started out of sight and 60 ft. under water, is extremely difficult but to date results have been satisfactory, and the templet speeds the operation of locating drilling rigs and starting the holes. The long bits inside the heavy casting start the hole accurately and the rock, which cuts out to about 18½-in. dia., keeps the bit very close to a true course. Little difficulty other than slow operation has been experienced in drilling holes or in removing cores despite unusual obstacles encountered.

As soon as a core is removed a current meter, bolted to a 17-in.-dia. casing 20 ft. long is connected to the drill rod and lowered to determine the velocities of flow at various depths in the hole. These velocities range up to 4.5 ft. per sec., thus necessitating some type of protection for freshly placed concrete.

Asbestos-cement pipe liner

Asbestos cement pipe has been found to be a satisfactory form of container for the concrete. The pipe is purchased in 13-ft. lengths in stock weights, 17¾ in. O.D. with ⅜-in. wall and 18 in. O.D. with ½-in. wall, the heavier material being used where long cavities are encountered. The pipe is assembled as shown in Fig. 7 with reinforcing inserted at points that come at the level of cavities. Joints are designed to be rigid, but no attempt is made to secure watertightness.

First procedure in the concreting operation is to place 10 cu. ft. of neat cement grout (0.4-W/C ratio) in the bottom of the 18½-in.-dia. hole through a 1½-in. pipe lowered to the bottom of the opening, grout being pumped in by the outfit used for pressure grouting. Next a section of asbestos-cement pipe is lowered into the hole together with a 6-in. tremie pipe, which is attached to the lower section of the liner. Sections of 6-in. pipe and asbestos cement pipe are added as the unit is lowered by a floating revolving crane. The 6-in. pipe is practically dry as it is lowered so advantage is taken of this opportunity to check the plumb of the hole with a flashlight let down on a wire inside the pipe. No readings are taken but some idea of the plumb can be obtained by watching the light.

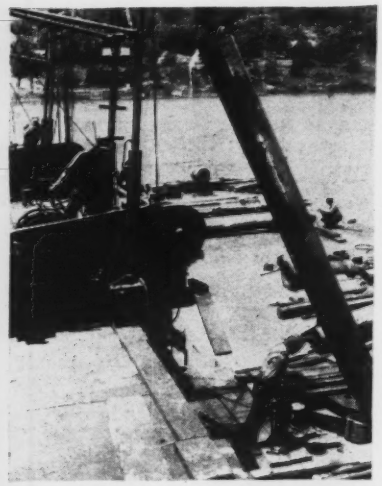


Fig. 2. Long 18-in.-dia. bit brings up 11 ft. 8 in. of core from more than 100 ft. below the surface.

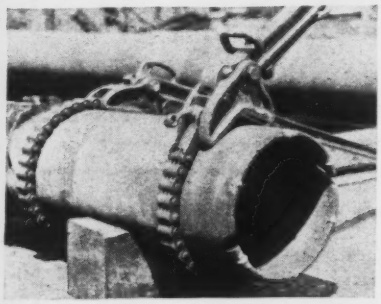


Fig. 3. Tungsten carbide "bumps" are welded on 1⅛-in.-thick bits to pass cavities where drilling shot is lost.

Fig. 4. Recovered cores show horizontal seams and vertical cavities. Black material is asphalt placed in 1926.

As soon as the hole is lined to the top of the rock, a 1½-in. pipe is lowered inside the 6-in. pipe and grout pumped in to force out any water and to seal the 6-in. pipe in preparation for placing tremie concrete. The 6-in. tremie pipe is then backed out of the threaded coupling cast in the base and concrete placed as the pipe is withdrawn. The hole is filled to the top of the liner and a little water into the larger casing at the rock surface. Concrete for this operation is prepared in a small mixer on a barge and placed with the floating crane.

Discarded ideas

The original plan for construction involved use of a fabric and rubber tubing, which was expected to keep the flow of water from the fresh concrete, but insertion of this material proved too difficult. It could not be bunched satisfactorily on a tremie pipe mandrel nor easily spliced under field working conditions though a type has been developed that can be joined with heat from a blowtorch. The tubing also bowed and flattened under the differential pressure at openings in the rock, difficulty being experienced despite use of expanded mesh cages inserted in the tubes. Subsequent boring of the overlapping holes indicated that in some cases the abrasive effect of rushing water and sediment had cut the tubing before the concrete hardened and washed out some material. Heavier tubing could have been secured and other devices worked out to make this scheme practical but the asbestos-cement pipe has been found to overcome most of the objections to the fabric and rubber tubing. It is somewhat less expensive in first cost when the expense of a full-height, expanded metal cage is included with the tubing. The pipe offers little resistance to the drills, yet has the beam strength and resistance to abrasive action necessary to protect the concrete.

The liner pipe first used was 17 in. O.D. as it was expected that the necessary splicing would be done on the outside. Since it proved more convenient to use an inside splice and since the 18-in. bits cut the holes to about 18½ in., a change was made to the larger and stock size of pipe.

Metal tubing was considered and could have been used for the closing hole, or even used for the first holes and subsequently drilled through, but it is more expensive and harder to get.

Schedule and labor required

The original estimate for the work contemplated drilling about 40,000 lin.ft. of 18-in. holes, which has since been supplemented by about 25,000 lin. ft. of diamond drill holes. About

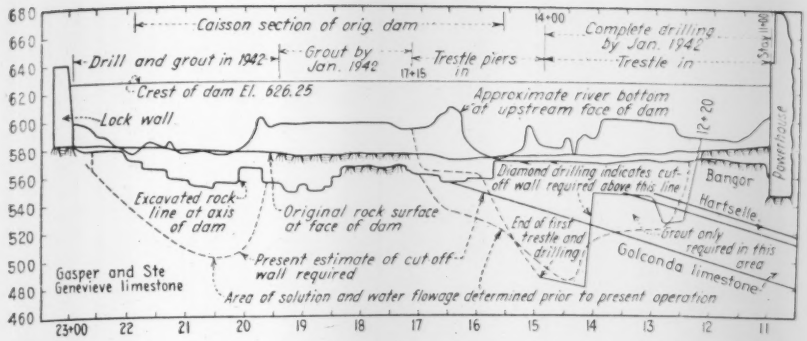


Fig. 5. Profile of areas of solution and water flowage with anticipated calyx drilling areas.

750 of the large holes will be required but present estimates indicate the possibility that only 30,000 lin. ft. may be drilled, of which more than 3,900 ft. is now completed and the holes concreted.

The regular drilling crew consists of one man and a helper on each rig with five men in a roving pulling crew that assists the drillers when a core is to be removed or other special work done. Early investigation indicated that about 5¼ in. per hour of net drilling time should be attained and that net drilling time should be about 80 percent of total time. Actually, during June, the average was 8¾ in. per hour with drilling in progress 85 percent of the gross time. The author watched the pulling crew bring up the bit from a depth of 102 ft., remove 11 ft. 8 in. of core, replace the bit and resume drilling in 28 min. from the time drilling stopped.

Since July 1 operations have been on a three-shift basis, and it is expected that the necessary cutoff wall for a 500-lin. ft. length starting 120 ft. from the powerhouse will be completed ahead of high water conditions next spring, and that the entire work will be completed during 1942.

New machines

Equipment in use until very recently has been two gasoline engine-driven drills rated as capable of cutting 36-in. cores to a depth of 200 ft. Nine new machines are now arriving rated for 48 in. at 200 ft. They have special 4-speed electric 40-hp. driving motors with a 20-hp. elcetric-drive hoist on one leg of the A-frame and an auxiliary 2,000-lb. line-pull air hoist on the other leg. These new machines, with variable rotating speeds and extra hoisting equipment, are expected to speed up the drilling operation substantially. Three gasoline engine-driven machines are used for the diamond core drilling.

Plans are being prepared for future raising of the crest of Hales Bar Dam from its present elevation of 626.25 to about El. 634 to provide more power and reduce the cost of attaining a 9-ft. navigation channel to Chickamauga Dam. The change is actually less than it appears, as the dam is presently operated with 3-ft. flashboards, and the increase will be made with movable gates.

The added height will increase the necessity for an apron to give less turbulence and reduce erosion downstream, so present plans contemplate that a cofferdam will be installed downstream and the area unwatered for construction of this facility. Such construction has not been possible previously because of the leakage under the dam. When the downstream side of the dam is unwatered it is planned to fill the existing cavities under the structure, probably with concrete placed through calyx holes drilled through the structure.

Grouting the entire foundation will probably follow to complete the repair work.

Personnel

The work is being done by TVA with its own forces. The scheme used for construction was devised and its construction is being supervised by Lewis A. Schmidt, Jr., formerly of the construction plant division of TVA and now construction engineer at the site. H. D. Towers is superintendent in charge of the construction and has worked out many of the details.

Col. Theodore B. Parker is chief engineer, A. L. Pauls construction engineer and R. T. Colburn, construction plant engineer for the Tennessee Valley Authority.

Fig. 6. Templet slips over end casings, then spaces intermediate holes on primary line. Removing bolted plates exposes holes that slip over end casing to space the overlapping holes, drilled partly into the first concrete placed.

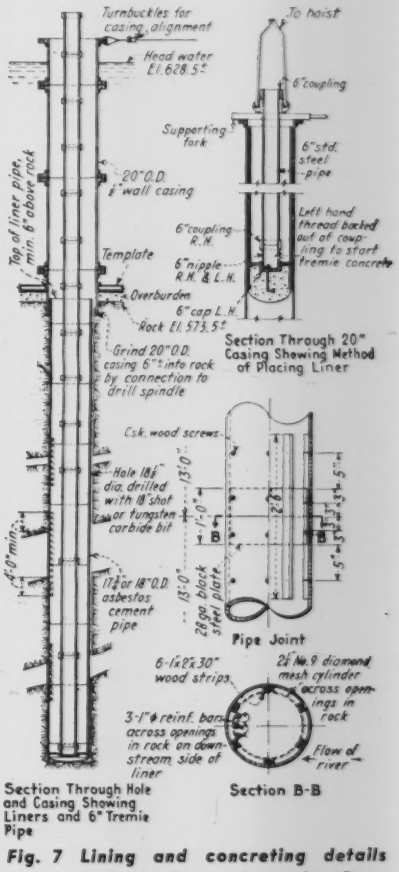

Turnbuckles for casing alignment
To hoist
Head water El. 628.5±
6" coupling
Supporting fork
6" std. steel pipe
20" O.D. ¿" wall casing
Top of liner pipe, min. 6" above rock
6" coupling R.H.
Left hand thread bolted out of coupling to start tremie concrete
Template
6" nipple R.H. & L.H.
Overburden
6" cap L.H.
Rock El. 573.5±
Section Through 20" Casing Shewing Method of Placing Liner
Grind 20" O.D. casing 6" into rock by connection to drill spindle
Csk. wood screws
Hole 18½" dia. drilled with 18" shot or tungsten carbide bit
13'-0"
1'-0"
B
4'-0" min.
11¾ or 18" O.D. asbestos cement pipe
13'-0"
28 ga. black steel plate
Pipe Joint
6-1x2½x30" wood strips
2½ No. 9 diamond mesh cylinder across openings in rock
3-1" ϕ reinf. bars across openings in rock on downstream side of liner
Flow of river
Section Through Hole and Casing Showing Liners and 6" Tremie Pipe
Section B-B

Fig. 7 Lining and concreting details for calyx drill holes at Hales Bar Dam. A smooth joint casing is used, above the rock, at each twelfth hole to permit sliding the templet on and turning it for drilling the overlapping holes.

Vertical-Lift Drydock for Small Boats

L. A. Francisco
Engineer, Ormond Beach, Fla.

A VERTICAL-LIFT DRYDOCK of 400 tons capacity for inspection and repair of small vessels at Daytona Beach, Fla., is a novel substitute for the more usual marine railway, in which the vessel is floated onto a cradle and pulled out of the water on an inclined track. This lift-dock has a water area 160x30 ft., and its sills are 13 ft. below low water, as most of the boats in the district have a draft of less than 8 ft.

The floor of the dock is a steel frame consisting of four longitudinal 8- and 12-in. I-beams supporting 14 transverse 24-in. I-beams 34 ft. long. A working floor is formed by 3-in. cypress planks seated on the bottom flanges of the 24-in. beams and held down by wood strips with braces wedged under the top flanges. On top of each floorbeam is a yellow-pine timber 4x14 in., on the middle of which is a cast-iron rack 4 in. wide, to engage the pawls on the bilge blocks or chocks which support the boat. These chocks slide on two 2x6 in. sticks, one on each side of the rack, the slides projecting beyond the 14-in. timber so as to afford a flange or grip to hold the hooked irons or rods that secure the chocks in position. On each end of the 24-in. floorbeam is a stirrup or hanger housing a pair of 18-in. sheaves.

Along each side of the dock is a trestle, with bents 10 ft. apart, built of creosoted piles and timber and heavily braced longitudinally. On the dock side of the trestle a pair of longitudinal 12-in. steel channels form a girder carrying a pair of 18-in. sheaves directly above those on the floorbeams of the dock. The local coquina rock and sand were dredged to the required depth, and unshod piles 32 to 40 ft. long were driven, with a penetration of 10 to 14 ft. This construction, shown in Fig. 2, is supplemented on one side by tie-rods attached to anchor piles 16 ft. in the rear. With a boat in the dock, the average pile load is 9 tons. Steel sheetpiling excludes silt and sand, and any such accumulation can be removed by a suction dredge.

Hoisting method

At the shore end of each trestle is a hoist having four drums on a shaft which is driven from a 25-hp. electric motor through V-belts and worm gearing. From these drums extend fourteen $\frac{7}{8}$-in. steel cables which pass over the sheaves on the trestle and down to the sheaves on the end of each floorbeam, forming a four-part tackle and returning to an attachment on the steel structure that carries the machinery. This structure takes the longitudinal and lateral pull of the cables, which have a maximum horizontal angle of 41½ deg. with the center line of the dock. The lift of 16 ft. is made in an average time of 30 min.

Pairs of sliding chocks or bilge blocks on the floorbeams, as already mentioned, are adjusted to fit the bottom of the boat and are then held in position by pawls engaging the racks. To shift the blocks, the pawls

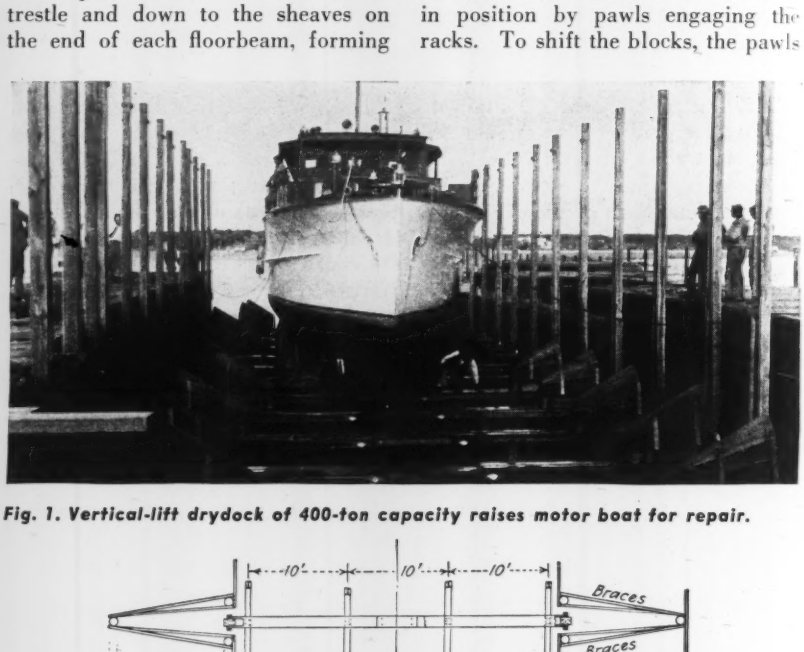


Fig. 1. Vertical-lift drydock of 400-ton capacity raises motor boat for repair.

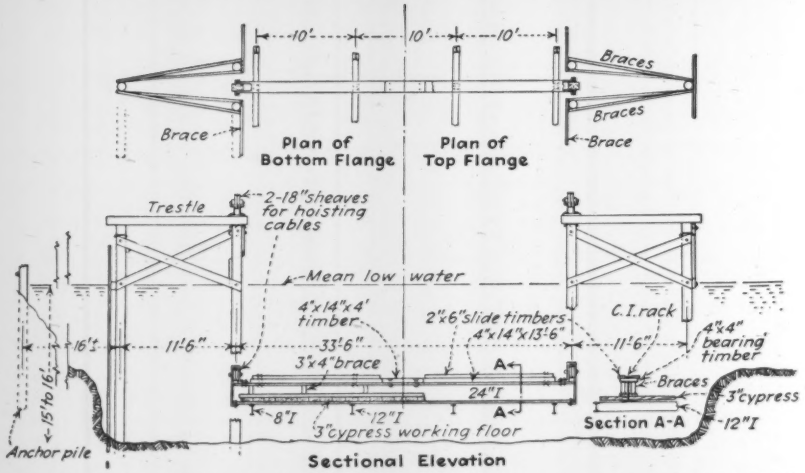


Fig. 2. The steel-frame dock floor (160x30-ft.) is carried up by hoisting cables.

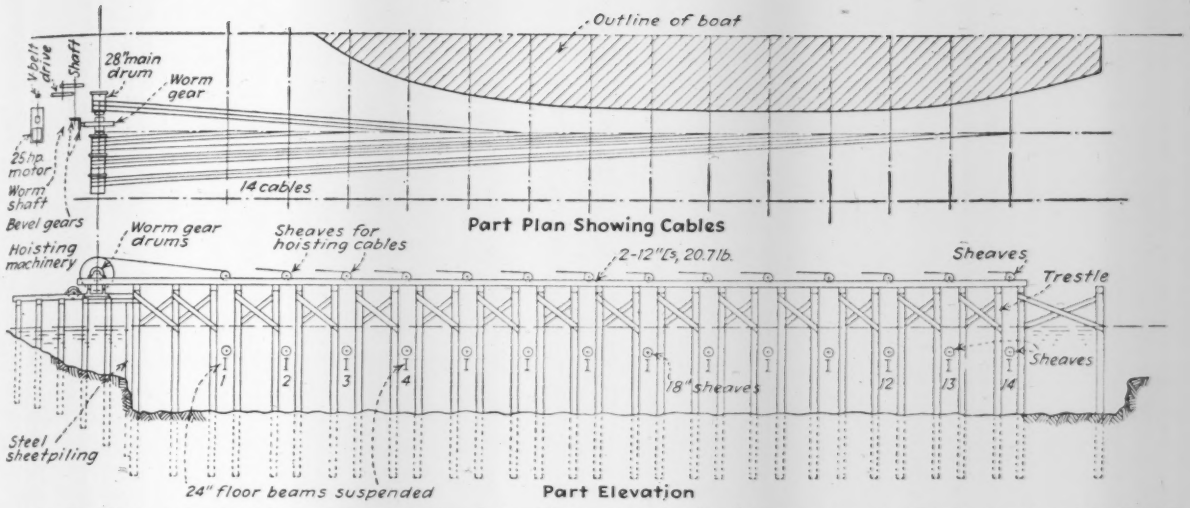


Fig. 3. Trestles and operating cables for lift-dock. The average lifting time required is 30 min. for the 16 ft. height.

are tripped by cables leading to vertical posts or stanchions at the ends of the floorbeams (see Fig. 1). The blocks are moved to and fro by loop lines reeved through pulleys at the center of the beam and then up to the deck or working platform of the trestle. Electric control buttons are provided at several points for the convenience of the men working the chocks.

The general idea of the lift dock was conceived by Sherburn M. Becker, president of the Daytona Beach Boat Works, Inc., and M. L. Chadwick, vice president. The writer was engineer in charge of construction.

Cleaning Steel for Painting Railway Structures

IN THE ANNUAL WORK of maintenance painting on steel bridges and buildings, the railways still rely largely on hand work for the preparatory cleaning of the metal, according to a report presented at the recent annual meeting of the American Railway Bridge and Building Association, held in Chicago. Of 33 railroads aggregating 206,694 miles of line, 21 roads with 65 percent of that mileage use hand cleaning methods for 50 to 100 percent of their annual programs. Pneumatic tools for such cleaning are used for 5 to 95 percent of the work on 25 roads with 155,000 miles (74.7 percent of total), and sandblasting by 16 roads with 56 percent of the total mileage reporting. A railroad using pneumatic tools on 66 percent of its work, and hand methods for the remainder, gives the comparative cost as shown in the accompanying table. The greater amount of paint used and higher cost of painting after pneumatic cleaning is held to indicate that a greater proportion of primer is used, and in less accessible places.

Although the practical development of flame-cleaning is of fairly recent origin, it is used by no less than 15 roads with 110,764 miles (53 percent of total). This process is said to cost considerably less than sandblasting, and to be specially efficient in the removal of heavy deposits of grease, dirt and rust scale. In the cleaning of a train shed, a certain amount of work cleaned by hand required 26.1 man-hours and a labor cost of $18.27, while an equal amount done by the flame method required 13 man-hours and represented a labor cost of $17.50.

COST OF CLEANING STEEL FOR PAINTING

	Hand Cleaning	Pneumatic Tool Cleaning
Cleaning, per ton	$1.12	$1.45
Painting, per ton	$1.10	$1.90
Total labor cost per ton	$2.22	$3.35
Paint per ton, gal.	0.53	0.81
Cleaning, per gal. of paint	$2.12	$1.79
Painting, per gal. of paint	$2.08	$2.35
Total labor cost per gal. of paint	$4.20	$4.14
Ratio of cleaning to painting	1.02	0.76

In the past few years there has developed an extensive use of petroleum oils and compounds impregnated with rust inhibitors. During the prolonged period of deferred maintenance this method was introduced as a means of reducing corrosion until painting could be done. At present, however, 22 of the railways listed, with 151,513 miles (or 73 percent of the total) are now using these petroleum products.

Flame-cleaning concrete

A novel use of the flame method was in removing a heavy layer of deteriorated paint from the concrete lining of a passenger tunnel at a terminal. There were 15 coats of waterproof and casein paint, approximately ¼ in. in thickness, and other methods used for cleaning had proved unsatisfactory in handling this particular problem.

The report states that under action of the flame the casein paint cracked off, while the waterproof coatings were reduced to a powder that was removed easily by wire brushes. The concrete surface was left dry and in good condition for receiving the new paint.

Designing Reinforced-Concrete Beams With Variable Moments of Inertia

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***Contents in Brief**—Determining angles of rotation of fixed-end beams and from them deriving the moments necessary for design can readily be done by the principle of area moments when the beam is of uniform section. The same principle, but accompanied by more difficult procedure involving integration, may be used when the beam has a variable section or moment of inertia by dividing the beam into a number of units and applying area moments to each. By summing these values the angles of rotation and end moments can be obtained. The mechanics of this procedure for several types of loading is presented together with a table of key coefficients of universal applicability.*

THE METHOD of expressing end moments in terms of the angular rotation of joints (generally known as the "slope-deflection" method), and the moment-distribution method have been employed for some time and are reasonably well understood by structural analysts; and especially in those cases where the moment of inertia is constant for each individual beam. Even for beams in which the moment of inertia varies within specified limits, numerous tables and diagrams have been published, but their use is naturally restricted, and furthermore a sufficient understanding of much of this literature requires considerable study if it is to be interpreted and used correctly. A simpler and more direct method of designing beams with variable moments of inertia, which means reinforced-concrete beams principally, is needed. The procedure outlined in this article is applicable for all kinds of variation in moments of inertia and for all classes and conditions of loading.

Constant moment of inertia

The beam AB, Fig. 1 (a) supports a uniform load of p lb. per ft. and is in partial restraint at each end by moments M_{ab} and M_{ba}. The bending moment diagrams for the end moments and the uniform load are shown separately in Figs. 1 (b) and (c). The lines AA′ and BB′ are tangents to the elastic curve; t_a and t_b are the tangential deviations; and ϕ_a and ϕ_a are the angles through which the partially restrained joints have been rotated.

By the principle of area moments

$$t_b = \frac{1}{EI}\int_0^l Mx\,dx \quad \ldots\ldots (1)$$

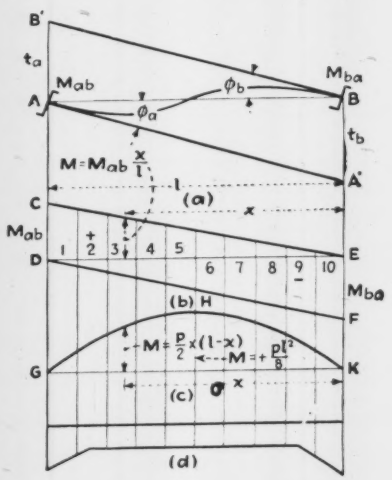


Fig. 1. Beams with constant and variable moments of inertia compared: (a) is the "constant" beam; (b) and (c) are its moment diagrams for end moments and uniform load respectively; (d) is the "variable" beam.

in which M is the bending moment at any distance x from the vertical through B, and E and I are the modulus of elasticity and moment of inertia, both assumed constant.

The integration may be performed by a semi-graphic process, since the integral represents the moment of the area of the bending moment diagrams about the vertical through B; whence

$$t_b = \frac{1}{EI}\left[\frac{l}{2}\,\frac{2}{3}\,lM_{ab} - \frac{l}{2}\,\frac{l}{3}\,M_{ba} + \frac{pl^2}{8}\,\frac{2}{3}\,l\,\frac{l}{2}\right]$$

$$= \frac{l^2}{6\,EI}\left[2\,M_{ab} - M_{ba} + \frac{pl^2}{4}\right]$$

Similarly, area moments about the vertical through A, give

$$t_a = \frac{l^2}{6\,EI}\left[M_{ab} - 2\,M_{ba} + \frac{pl^2}{4}\right]$$

$$\phi_a = \frac{t_b}{l} = \frac{l}{6\,EI}\left[2\,M_{ab} - M_{ba} + \frac{pl^2}{4}\right]$$

$$\phi_b = \frac{-t_a}{l} = \frac{l}{6\,EI}\left[2\,M_{ba} - M_{ab} - \frac{pl^2}{4}\right]$$

from which

$$M_{ab} = \frac{2\,EI}{l}\left[2\,\phi_a + \phi_b\right] - \frac{pl^2}{12} \quad \ldots (2)$$

$$M_{ba} = \frac{2\,EI}{l}\left[2\,\phi_b + \phi_a\right] + \frac{pl^2}{12} \quad \ldots (3)$$

Variable moment of inertia

When the moment of inertia of the beam varies as in Fig. 1 (d) the term I in Eq. (1) must remain under the integral sign thus

$$t_b = \frac{1}{E}\int_0^l \frac{Mx\,dx}{I}$$

or $$\phi_a = \frac{t_b}{l} = \frac{1}{E}\int_0^l \frac{Mx}{l}\,\frac{dx}{I} \quad \ldots (4)$$

TABLE I—UNIVERSAL KEY COEFFICIENTS

Div.	C_1	C_2	C_3	C_4	C_5	C_6	C_7	C_8	C_9
1	.9633	.0467	.0033	.0218	.0015	.0140	.0010	.95	.05
2	.7233	.1267	.0233	.0535	.0098	.0330	.0060	.85	.15
3	.5633	.1867	.0633	.0698	.0235	.0407	.0137	.75	.25
4	.4233	.2267	.1233	.0735	.0398	.0404	.0218	.65	.35
5	.3033	.2467	.2033	.0678	.0556	.0350	.0287	.55	.45
6	.2033	.2467	.3033	.0556	.0678	.0269	.0327	.45	.55
7	.1233	.2267	.4233	.0398	.0735	.0180	.0331	.35	.65
8	.0633	.1867	.5633	.0235	.0698	.0099	.0291	.25	.75
9	.0233	.1267	.7233	.0098	.0535	.0038	.0206	.15	.85
10	.0033	.0467	.9033	.0015	.0218	.0005	.0077	.05	.95
$\Sigma\frac{1}{10}$	3.333	1.667	3.333	.4167	.4167	.2222	.1944		
$\Sigma\frac{2}{3}$	.6932	.9068	1.4932	.1867	.2667	.0898	.1236		
$\Sigma\frac{5}{8}$	1.6798	1.3202	1.6798	.3300	.3300	.1709	.1591		

and I must be expressed as a function of x if integration is to be performed.

An approximate solution may be made by summation instead of integration, i.e.,

$$\phi_a = \frac{1}{E}\sum\frac{Mx\Delta x}{lI} = \frac{1}{E}\sum\frac{\Delta x}{I}\frac{Mx}{l} \quad (5)$$

in the following manner:

Divide the M and I diagrams into ten equal divisions, $\Delta x = \frac{l}{10}$ in length. Find the average h for each division. Compute $\frac{\Delta x}{I}$ for each division. In computing $\frac{Mx}{l}$ for each division it is expedient to treat each M diagram separately. In the computations for ϕ_a, the origin for x is on the vertical through B.

Consider, for example, division 3 in the M diagram CDE, where the bending moment at any distance x is

$$M = \frac{x}{l} M_{ab}$$

The moment of the area of division 3 about B is

$$Mx\,\Delta x = \int_{.7l}^{.8l} Mx\,dx = \frac{M_{ab}}{l}\int_{.7l}^{.8l} x^2\,dx$$
$$= 0.05633 l^2 M_{ab}$$

$$\frac{Mx}{l} = \frac{Mx\,\Delta x}{l\,\Delta x} = \frac{0.05633 l^2 M_{ab}}{0.1 l^2}$$
$$= 0.5633\,M_{ab} = C_1 M_{ab}$$

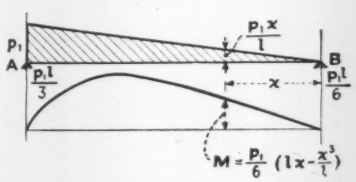


Fig. 2. Moment diagram for a load on a beam varying uniformly from a maximum at one end to zero at the other.

where $C_1 = 0.5633$ for division 3, as given in Table I.

In the M diagram GHK for a uniform load of p lb. per ft.

$$M = \frac{p}{2} x\,(l - x)$$

For division 3,

$$Mx\,\Delta x = \int_{.7l}^{.8l} Mx\,dx$$
$$= \frac{p}{2}\int_{.7l}^{.8l} x^2\,(l - x)\,dx = 0.00698\,pl^4$$

$$\frac{Mx}{l} = \frac{0.00698\,pl^4}{0.1\,l^2} = 0.0698\,pl^2 = C_4\,pl^2$$

where $C_4 = 0.0698$ for division 3, as given in Table I.

The M diagram for a uniformly varying load is shown in Fig. 2. The intensity of the load distant x from B is $\frac{p_1 x}{l}$, and the bending moment is

$$M = \frac{p_1 l}{6}x - \frac{p_1}{l}\frac{x}{2}\frac{x}{3}$$
$$= \frac{p_1}{6}\left(l x - \frac{x_3}{l}\right)$$

For division 7,

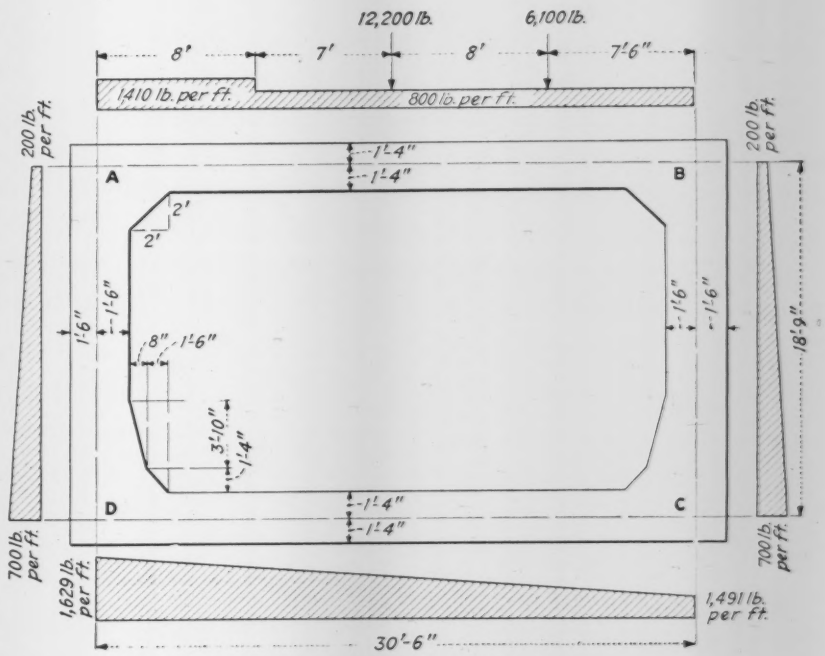
$$Mx\,\Delta x = \frac{p_1}{6}\int_{.3l}^{.4l}\left(l x^2 - \frac{x^4}{l}\right)dx$$
$$= 0.0018\,p_1 l^4$$

and $\frac{Mx}{l} = 0.018\,p_1 l^2 = C_6\,p_1 l^2$

where $C_6 = 0.018$ as given for division 7 in Table I.

Eq. (5) may be expanded to read

$$\phi_a = \frac{1}{E}\left[\sum\frac{\Delta x}{I} C_1 M_{ab} - \sum\frac{\Delta x}{I} C_2 M_{ba} + \sum\frac{\Delta x}{I} C_4\,p\,l^2 + \sum\frac{\Delta x}{I} C_6\,p_1 l^2 + \sum\frac{\Delta x}{I} C_7 M\right]. \quad (6)$$



Cross Section of Tunnel

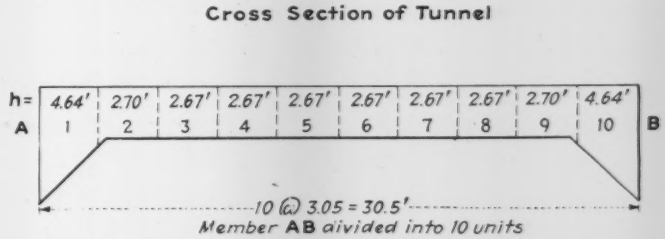


Fig. 3. Tunnel section made up of members that have variable moments of inertia.

TABLE II—MEMBER A B

Div.	h	$I=\frac{h^3}{12}$	$\frac{\Delta x}{I}$	$C_1\frac{\Delta x}{I}$	$C_2\frac{\Delta x}{I}$	$C_3\frac{\Delta x}{I}$	$C_4\frac{\Delta x}{I}$	$C_5\frac{\Delta x}{I}$
1	4.64	8.3248	.3664	.3310	.0171	.0012	.0080	.0005
2	2.70	1.6402	1.8595	1.3450	.2356	.0433	.0995	.0182
3-8	2.67	1.5862	1.9228	3.2299	2.5385	3.2299	.6345	.6345
9	2.70	1.6402	1.8595	.0433	.2356	1.3450	.0182	.0995
10	4.64	8.3248	.3664	.0012	.0171	.3310	.0005	.0080
			Σ^{1}_{10}	4.9504	3.0439	4.9504	.7607	.7607

Likewise,

$$\phi_b = \frac{1}{E}\left[-\sum\frac{\Delta x}{I} C_2 M_{ab} + \sum\frac{\Delta x}{I} C_3 M_{bb} - \sum\frac{\Delta x}{I} C_6 p l^2 - \sum\frac{\Delta x}{I} C_7 p_1 l^2 - \sum\frac{\Delta x}{I} C_9 M\right] \ldots (7)$$

In Eq. 6, the area moments are about the vertical through B, and in Eq. 7, they are about the vertical through A. Each term is to be computed for each division and the sum taken. The coefficients C for each division are given in Table I. When the beam supports no load between A and B, p, p_1 and M are zero. The symbol M in the last term of each equation refers to concentrated loadings of any pattern where the bending moment M is not a continuous function of x, and any general expression of M in terms of x becomes involved. Any specific arrangement of loads may be evaluated with comparative ease as will be shown later.

Applying the method

The cross-section of an underground reinforced-concrete tunnel is shown in Fig. 3. The fictitious vertical loading on AB is chosen for illustrative purposes, and the uniformly varying vertical reaction is determined by statics. The horizontal loads are assumed earth pressures. All loads are for a 1-ft. length of tunnel, and all dimensions are in ft.

Dividing member AB into ten units, $\Delta x = \frac{l}{10} = 3.05$ ft. The average depths, h, as shown for each division are also given in Table II. In assuming $I = \frac{b}{12}\frac{h^3}{}$, where $b = 1$, no consideration is given to the reinforcing. In computing the unknown corner or end-moments, it is the *relative* and not the absolute values of I that are significant, consequently, the assumption, that $I = \frac{h^3}{12}$, thereby giving no consideration to the effect upon I of the reinforcing, is permissible. Also, if the structure is of the same material throughout, the modulus of elasticity, E, has no effect upon the corner moments, and is omitted from Eq. (6) and (7).

For division 1, $\frac{\Delta x}{I} = 0.3664$, Table II; and C_1 from Table I is 0.9033. For divisions 3 to 8 inclusive $\frac{\Delta x}{I} = 1.9228$. Taking the sum of the values of C_1 for divisions 3 to 8, $\sum_3^8 C_1 = 1.6798$, hence $\frac{\Delta x}{I}\sum_3^8 C_1 = 3.2299$.

For the uniform load $p = 800$ lb. per ft., $pl^2 = 744{,}200$, hence, in Eq. 6,

$$\sum_{10}^{1}\frac{\Delta x}{I} C_4 p l^2 = 0.7607 \times 744{,}200 = 566{,}100$$

For the remainder of the load on AB, the bending moment M at the *middle* of each division is computed and listed in Table III. Assume (with slight error) that the centroid of each division is on the mid-vertical then $\frac{x}{l}$ for each division will be as given under C_8 and C_9 in Table I, and the remainder of Table III is computed.

All the terms in Eq. (6) and (7) have now been evaluated, in Tables II and III. With $p_1 = 0$, and substituting in Eq. (6) and (7) from tables II and III.

TABLE III—MEMBER A B

Div	M	C_8M	C_9M	$\frac{\Delta x}{I}$	$\frac{\Delta x}{I}C_8M$	$\frac{\Delta x}{I}C_9M$
1	17500	16600	900	.3664	6100	300
2	48200	41000	7200	1.8595	76200	13400
3	73300	55000	18300			
4	94900	61700	33200			
5	116400	64000	52400			
6	116300	52300	64000	1.9228	556500	571100
7	100600	35200	65400			
8	84900	21200	63700			
9	51400	7700	43700	1.8595	14300	81300
10	17100	900	16200	.3664	300	5900
	720600	355600	365000		653400	672000
		Σ_8^3 289400	297000			

$$\phi_a = 4.9504M_{ab} - 3.0439M_{ba} + 500\,(10) + 653400$$
$$\phi_b = -3.0439M_{ab} + 4.9504M_{ba} - 566100 - 672000$$

Reducing

$$M_{ab} = .3248\,\phi_a + .1997\,\phi_b - 148800\,(8)$$
$$M_{ba} = .3248\,\phi_b + .1997\,\phi_a + 158500\,(9)$$

The computations for member DA are given in Table IV. The load is considered in two parts, a uniform load of $p = 200$ and a load varying uniformly from zero at division 10 to $p_1 = 500$ at division 1.

Therefore,

$$\phi_d = 1.6867\,M_{da} - 1.1797\,M_{ad} + .2872\,pl_2 + .1495\,p_1 l_2$$
$$\phi_a = -1.1797\,M_{da} + 1.8824\,M_{ad} - .3025\,pl_2 - .1429\,p_1 l_2$$

whence

$$M_{da} = 1.0555\,\phi_d + .6615\,\phi_a - 18400\,(10)$$
$$M_{ad} = .9458\,\phi_a + .6615\,\phi_d + 13100\,(11)$$

Turning to member CB, the moments may readily be computed by substituting C for D and B for A in the above equations and changing signs of numerical terms that represent the load, since it acts opposite to that for AD. Thus,

$$M_{cb} = 1.0555\,\phi_c + .6615\,\phi_b + 18400\,(12)$$
$$M_{bc} = .9458\,\phi_b + .6615\,\phi_c - 13100\,(13)$$

If either the members or the loads were unlike, then CB would require a separate analysis. It should be noted, however, that in so doing, the end C should be on the left so that the intensity p_1 falls in division 1.

For member DC, the divisions and their respective h values are as follows: division 1 = 4.57; 2 = 2.78; 3 to 8 = 2.67; 9 = 2.78; 10 = 4.57. From these it may be computed that

$$M_{dc} = .3349\,\phi_d + .2076\,\phi_c + 140300\,(14)$$
$$M_{cd} = .3349\,\phi_c + .2076\,\phi_d - 137300\,(15)$$

Both end moments in Fig. (1) are assumed to have a clockwise rotation, consequently the sum of the end moments at any joint equals zero: for the joint A

$$M_{ab} + M_{ad} = 0$$

Substituting from Eq. (8) and (11)

$$1.2706\,\phi_a + .1997\,\phi_b + .6615\,\phi_d = +135700\ldots\ldots(16)$$

Similarly, at joints B, C and D, the sums of the end moments are

$$1.2707\,\phi_b + .1997\,\phi_a + .6615\,\phi_c = -145400\ldots\ldots(17)$$
$$1.3904\,\phi_c + .6615\,\phi_b + .2076\,\phi_d = +118900\ldots\ldots(18)$$
$$1.3904\,\phi_d + .6615\,\phi_a + .2076\,\phi_c = -121900\ldots\ldots(19)$$

Solving Eq. (16) to (19) simultaneously

$\phi_a = +293000$: $\phi_b = -300100$: ϕ_c
$= +268200$: and $\phi_d = -267100$

Substituting in Eq. (8) to (15),

$M_{ad} = +113500$ $M_{ab} = -113500$
$M_{ba} = +119500$ $M_{bc} = -119500$
$M_{cd} = +102900$ $M_{cb} = -102900$
$M_{da} = +106500$ $M_{dc} = -106500$

Application to moment distribution

If one prefers the moment distribution method, the fixed-end moments, distribution and carry-over factors may be obtained from the foregoing equations. When joints A and B are fully restrained ϕ_a and ϕ_b in Eq. (8) and (9) are zero, hence the fixed-end moment in the beam AB at A is —148,800. The minus sign indicating an opposite rotation to that shown in Fig. (1), at B the fixed end moment is + 158,500.

At joint A, the moment to be distributed to balance the joint is + 135,700 as shown in Eq. (16). The portion going to AB is the ratio of the coefficients of ϕ_a in Eq. (8) and (16) or

$$\frac{.3248}{1.2706} = .256: 135700 \times .256 = 34700$$

The portion going to AD is

$$\frac{.9458}{1.2706} = .744: 135700 \times .744 = 101000$$

The carry-over factor in AB is the ratio of the coefficients of ϕ_a and ϕ_b in Eq. (8) and (9) or

$$\frac{.1997}{.3248} = .615 \text{ for both ends.}$$

The member AD is unsymmetrical and the carry-over factors are different for each end. From Eq. (10) and (11) the carry-over factor from A to D is

$$\frac{.6615}{.9458} = .699: \text{ and the carry-over factor from D to A is}$$

$$\frac{.6615}{1.0555} = .627$$

TABLE IV—MEMBER D A

Div.	h	$I = \frac{h^3}{12}$	$\frac{\Delta x}{I}$	$C_1 \frac{\Delta x}{I}$	$C_2 \frac{\Delta x}{I}$	$C_3 \frac{\Delta x}{I}$	$C_4 \frac{\Delta x}{I}$	$C_5 \frac{\Delta x}{I}$	$C_6 \frac{\Delta x}{I}$	$C_7 \frac{\Delta x}{I}$
1	5.61	14.7132	.1274	.1151	.0059	.0004	.0028	.0002	.0018	.0001
2	3.80	4.5727	.4100	.2966	.0519	.0095	.0219	.0040	.0135	.0025
3	3.32	3.0495	.6148	.3463	.1148	.0389	.0429	.0144	.0250	.0084
4	3.04	2.3412	.8009	.3390	.1816	.0988	.0589	.0319	.0324	.0175
5-8	3.00	2.2500	.8333	.5776	.7556	1.2443	.1556	.2222	.0748	.1030
9	3.56	3.7598	.4987	.0116	.0632	.3607	.0049	.0267	.0019	.0103
10	5.39	13.0492	.1437	.0005	.0067	.1298	.0002	.0031	.0001	.0011
			Σ_{10}	1.6867	1.1797	1.8824	.2872	.3025	.1495	.1429

The carry-over factor in a beam having constant moment of inertia is $\frac{1}{2}$ as shown in Eq. (2) and (3). In beams haunched at the ends this factor is always greater than $\frac{1}{2}$; consequently more distributions are necessary when the beams are haunched.

A structure may contain members as well as joints which are subject to rotation. If the change in lengths of vertical members in Fig. (4) is neglected, the joints D and F will deflect to D′ and F′ and the relative movement of B with respect to A will be BB′. Five members as well as all joints are subject to rotation. Let ψ with subscripts represent the angular rotation of the members. Then

$$DD' = 10\psi_{cd} = -8\psi_{ad}; \psi_{ad} = -1.25\psi_{cd} \quad \ldots\ldots(20)$$

$$FF' = 12\psi_{ef} = -21\psi_{gf}; \psi_{ef} = -1.75\psi_{gf} \quad \ldots\ldots(21)$$

$$BB' = FF' - DD'$$
$$20\psi_{ab} = -21\psi_{gf} - 10\psi_{cd}; \psi_{ab} = -1.05\psi_{ef} - 0.5\psi_{cd} \quad \ldots\ldots(22)$$

Consider any member as DA in Fig. (3). The end-moment equations are (10) and (11). It can be proved that if this member had been subject to an angular rotation $\psi_{ad} = \psi_{da}$, the equations could have been transformed to suit this condition by including the angle ψ_{ad} with a negative coefficient equal to the sum of the coefficients of ϕ_a and ϕ_d as follows:

$$M_{da} = 1.0555\,\phi_a + .6615\,\phi_a - 1.7170\psi_{ad} - 18400 \quad \ldots\ldots(10a)$$

$$M_{ad} = .9458\,\phi_a + .6615\,\phi_d - 1.6073\psi_{ad} + 13100 \quad \ldots\ldots(11a)$$

in which ϕ_a and ϕ_d represent the angular rotation of the joints and ψ_{ad} the angular rotation of the member.

In Fig. 4 there are ten unknown angles ϕ, one for each joint; and five unknown angles ψ, which may be expressed in terms of the two angles ψ_{cd} and ψ_{gf} as shown in Eq. (20), (21), and (22). Ten equations, one for each joint, may be written. Two additional equations are required for a solution. One may be written by equating the reaction of column AD at A to its load at D as follows, referring to the sketch at the right in Fig. 4,

$$M_{ca} + M_{ba} + 20R_a = 200p$$
$$M_{cd} + M_{dc} + 50p + 10R_{dc} = 0$$
$$M_{da} + M_{ad} = 8R_{da}$$
$$R_a = R_{dc} + R_{da}$$

whence

$$\frac{200p - M_{ab} - M_{ba}}{20} = \frac{-50p - M_{cd} - M_{da}}{10} + \frac{M_{ad} + M_{da}}{8} \quad \ldots\ldots(23)$$

A similar equation may be written for column BF.

In a structure having but four joints as in Fig. 3, probably the best method is to solve the four equations simultaneously. With a large number of equations, a solution by approximations may be preferable, if the carry-over factor is not too large.

The two hinged rectangular arch as usually designed is in a class by itself, since it has a uniform variation of width in the posts and a parabolic variation of depth in the deck. The moment of inertia of each member may be expressed as a continuous function and integration instead of summation may be made. Consequently the statically indeterminate corner bending moment may be expressed in one simple equation for each pattern of loading whether dead or live, whether vertical or horizontal, including correction for temperature. (See *Bulletin No. 79*, Purdue Univ. Eng. Experiment Station.) In the solution of such a problem, any method of successive approximations is manifestly a fetish.

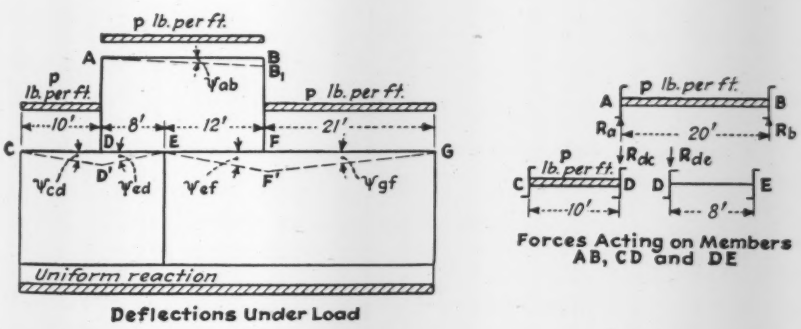


Fig. 4. Structure in which members as well as joints are subject to rotation.

Developments in Sewage Disposal

Recent advances in sewage treatment research and practice were highlight topics on the technical program of the second annual convention of the Federation of Sewage Works Association held in New York, Oct. 9-11. Abstracts of some of the papers are contained in this report. Other happenings at the convention were described in a news account in ENR Oct. 16, 1941, p. 527.

FERTILIZER FROM SCREENINGS

Fine screenings from New York City's Jamaica sewage treatment plant are converted into fertilizer by means of composting with gypsum and straw. The screenings first are dewatered on a centrifuge to reduce the moisture content from an initial 90 percent to 70 percent. To the disintegrated cake discharged from the centrifuge there is added about 2 percent ground gypsum by weight and 2 percent cut straw by volume. These simple materials, costing about 30c. per ton of cake, are effective in bringing about the desired change in the material.

Disintegrated cake is spread in layers about 18 in. deep, and within a few hours the surface temperature rises to 60 deg. C. and a growth of white mold starts. In about 30 days the thermophilic heat action results in partial disintegration of the cellulose and other sewage materials. The finished material has a brown chocolate color and is almost undistinguishable from good humus, which in fact it is.

Analysis of the finished material shows:

Total nitrogen	2.60%
Phosphoric acid	1.21%
Fat	3.10%
Fiber	28.20%
Ash	19.80%

During 1940 some 800 tons of this fertilizer were distributed to the city park department and in 1941 to Sept. 30 some 775 tons have been used.—WELLINGTON DONALDSON, *director, Bureau of Sewage Disposal, New York City Department of Public Works.*

ACTIVATED SLUDGE WITH MULTIPLE-POINT DOSING

In the activated sludge process, as conventionally conducted, the entire flow of sewage is impressed upon the returned sludge in a single dose. Although the nature of the individual links in the chain of purifying events that is thereby uncoiled is, as yet, but vaguely known, it is generally thought that two broad classes of happenings can be distinguished:

1. A physical process of adsorption and flocculation, which is instituted immediately, proceeds rapidly, and decreases in rate as the suspended, colloidal and dissolved substances are removed from the sewage to the sludge flocs; and

2. A biological process of food consumption for energy production and cell synthesis. This process is instituted immediately but proceeds more slowly and, after a probable initial acceleration, is retarded gradually as the food substances contained in the sewage are consumed or changed in character by bacteria and other primitive organisms that flourish in activated sludge, and, by their foraging activities, regenerate the contact surfaces of the sludge flocs.

In 1937 Prof. Gordon M. Fair of Harvard University advanced the hypothesis that incremental addition of sewage to returned activated sludge along the line of flow would help to equalize the physical and biological phases of the activated sludge process and thereby increase efficiency or economy. At about the same time, this hypothesis found independent expression in the provision by Richard H. Gould, acting deputy commissioner, department of public works, New York City, of means for introducing sewage at three points along the aeration units of the Tallmans Island activated sludge plant.

Laboratory investigations at Harvard have now produced results which (1) show that it is possible to maintain the activated sludge process by adding sewage gradually to returned sludge instead of in a single dose, and (2) suggest that this modified process gives promise of establishing certain economies in plant design and operation, provides greater flexibility in treatment control, and reduces risk of sludge deterioration from the sudden imposition of batches of industrial wastes. Mr. Gould has called the method of operation incorporated at Tallmans Island step-aeration; the authors prefer to identify the principle involved as distributed loading, multiple-point dosing, or incremental dosing.

Load distribution appears to provide a workable modification of the activated sludge process by maintaining oxygen demand at a more uniform level than the conventional method of operation, producing an indigenous activated sludge with good purifying capacity and settling properties, discharging a good effluent without increasing the air consumption, and effecting a saving (23 to 35 percent) in tank volume. Load distribution requires no special equipment, is readily incorporated in conventional tanks by the provision of sewage inlets and transverse baffles, and gives promise of increasing the capacity of overloaded aeration units by more effective use of available tank volume. Further, load distribution seems to render operation of aeration units flexible, making it possible to adjust the character of the sludge produced to the needs of the sewage treated, aiding in the control of bulking and blanket rising, and reducing the shock of sudden discharges of industrial or otherwise objectionable wastes.—J. E. MCKEE and GORDON M. FAIR, *Harvard Graduate School of Engineering, Cambridge, Mass.*

SEWAGE TREATMENT IN NEW YORK CITY

There are perhaps two general situations in New York City that in large measure control the type of works built and operated here. The first and major consideration is that they must be built in congested areas close to residences and large groups of people. The type of works built, therefore, must have its operations so controlled that no odors result and that the operations are not unsightly or otherwise offensive. The second

controlling consideration is that most of the major plants in that city are accessible to tidewater, which means that there is available a cheap and efficient method of disposing of solids at sea.

By far the greatest part of the sludge from New York City plants goes to sea, the bulk of it being a mixture of raw and activated sludge from Wards Island. This operation is quite successful. Last year three 1,500-ton diesel-operated vessels disposed of sewage solids 11 miles from land at a cost for direct operation and maintenance of $1.88 per million gallons of sewage treated or $2.40 per ton of dry solids, and this included rather heavy charges for collision damage, which we hope are unusual.

The real problem in the handling of raw sludge is in the control of odors. The sludge storage tanks on Wards Island hold about 188,000 cu.ft. and at times the odor above them in the inclosing building is terrific. These gases are drawn at the rate of 15,000 cfm. through activated carbon filters and given an application of about 40-60 grams of ozone per hour. This is the only installation of this type that I know of in a sewage plant. It has resulted in an adequate control of odor. At times when the filters have not been working reasonable results have been secured with ozone alone. We have no good quantitative method of measuring the odor removal of the proportion of work done by the activated carbon and ozone. The filters alone may remove from 80 to 90 percent of the odors, judged by general impressions of different observers. Their effectiveness, of course, depends on the effective capacity remaining in the activated carbon.

Great flexibility in operation is possible in the provisions made at the Tallmans Island activated sludge plant for "step aeration." Under this system sludge is returned from the final tanks to the head end of the aeration tanks. Here it may be joined by the entire flow of settled sewage as in the conventional system or this settled sewage may be added to the returned sludge at two additional points along its flow through the tanks. The amounts added in each of the three steps can be varied or entirely eliminated as desired.

As a result of two years' experience with the system, it has been found best to use both conventional and "step" aeration as conditions dictate. Robert Shapiro, the chemist there, gives some of these controlling conditions as follows:

"Step aeration" is used (the number of steps used being dependent on the intensity of the conditions): (1) when there is persistent increase in volatile content of the activated sludge—indicating the need for more oxidation of absorbed organics; (2) when the sludge index is decreasing steadily or the dissolved oxygen is dropping steadily—which indicates the need for increased sludge aeration period as the sludge is probably overloaded; and (3) in case of high spherotilus growths—which is taken as an index of overloading or poor sludge condition.

Conventional aeration is used: (1) when primary effluent solids are low or flow is low—conventional aeration permits carrying less solids in the aerator, but with the same end concentration, avoiding undernourished activated sludge; and (2) when there is over-aeration—as indicated by high dissolved oxygen values and a pinpoint floc in the final effluent that does not settle readily.—RICHARD H. GOULD, *acting deputy commissioner, New York Department of Public Works.*

STREAM POLLUTION CONTROL

Unless more progress is made by the states in solving their unyielding industrial waste problems, we must be prepared to accept federal administration of pollution control in some form. Maybe we will have it anyway.

There is unquestioned need for improvement in statutory law covering procedure and financing and as an aid to the solution of certain state and interstate problems. But various federal bill-drafters hope to make uniform the pollution statutes of all the states, following some national pattern. Have they overlooked the uniformity and protection against pollution and other water abuses, already available? This is inherent in the so-called common or court-made law of the United States and of the several states.

What then is this common law as it relates to waters? It is a compendium of the decisions of the state and federal appellate courts, classified to bear upon definite subjects with related facts. Its original foundation was the English common law. This was accepted conditionally or in its entirety by the states of the Union as they were organized. It also serves as a foundation of jurisprudence of the United States courts. Only to the extent that subsequent statutory enactments have come and gone, and court decisions modified it, has the common law been changed. Hence for any present lack of statutory enactment, the aggrieved party is rarely without a remedy.

It would seem entirely unnecessary, therefore, that anyone concerned with state stream pollution control should be awaiting the enactment of any federal law with the idea that this is necessary to establish uniform national policy. The doctrine and principles of the common law already provide this uniformity. The only safe criterion of water quality in the cross fire of interests in which we find ourselves is that of "reasonable use," interpreted in the light of each differing set of facts and circumstances. Moreover, "reasonable use" will be the criterion where pollution abatement is sought by injunctive process in either state or federal court. The test of injury, however, may be expected to be more strict and difficult to prove in federal than in state courts. All of us cannot wear the same size hat or shoes—neither can all pollution problems be equitably solved with the same remedy or the same degree of treatment.—MILTON P. ADAMS, *executive secretary-engineer, Stream Control Commission, Lansing, Mich.*

GAS ENGINE OPERATION

Experience at the Green Bay, Wis., sewage disposal plant with gas utilization has shown that with an average flow of 8.2 mgd., the sludge therefrom yielded an average of 54,000 cu.ft. of gas per day, which is equivalent to approximately 1 cu.ft. per capita per day or 10.6 cu.ft. per pound of volatile matter added to the digesters. By utilizing all of this gas in two engines, there was produced 760,000 kw.-hr. of power consuming about 26 cu.ft. of gas per kilowatt hour produced. Of this amount of power 96 percent was consumed in operating the plant, with the remaining 4 percent going back into the utility company's high lines.

The net profit from utilizing this gas in engines, deducting proper charges for interest on investment, depreciation of equipment and struc-

tures, repairs and maintenance, all operating supplies and labor, was $19,574 during the last four years.—GEORGE MARTIN, *sewerage works superintendent, Green Bay Metropolitan Sewerage District, Green Bay, Wis.*

Discussion—Mr. Martin has shown the savings that can be realized by utilizing sludge gas. In the original Green Bay, Wis., plant, where gas was used only for firing boilers, the savings amounted to $14 a day. Later, by installing two gas-engine-generators, the savings increased to about $10,000 a year or roughly $27 a day. It is now possible to produce practically all the electrical power required by the Green Bay plant and at the same time recover as much heat as could be produced by the plant boilers burning an equivalent amount of gas.

Articles in the technical press dealing with sludge gas utilization indicate that there is probably no other subject in sewage treatment in which so many authors arrive at the same conclusion. Estimates of the savings (expressed in terms of the time period in which the units pay for themselves) range from one to twelve years, or a return on the investment of between 8 and 100 percent per year. The use of safety devices and burners now on the market makes it possible for even small plants to utliize sludge gas. Units for heating small buildings are available that burn about 100 cu.ft. of gas per hour. Thus a plant serving a community of 2,000 people would prduce enough gas to supply one of these units.—PAUL D. MCNAMEE, *chemist, District of Columbia sewage treatment plant.*

STUDIES OF THE GUGGENHEIM BIO-CHEMICAL PROCESS

The Guggenheim process of sewage treatment involves the addition to the inflowing sewage of returned sludge, and a solution of ferric sulphate or equivalent coagulant; followed by aeration, sedimentation, discharge of the purified supernatant, and return of a portion of the sludge. In these operational features, therefore, the process resembles a combination of chemical precipitation and activated sludge treatment.

Studies carried out during the early development of the process, and subsequently, indicated certain distinct advantages over such a mere combination, noticeably in shortening of the necessary reaction period. It was believed that some novel mechanism or reaction had been introduced and the name Bio-chemical process was adopted to suggest this novel feature. The present studies were undertaken, therefore, not so much to test or demonstrate the indicated advantages as to learn through carefully controlled laboratory experiments as much as possible of the fundamental principles upon which the operation of the Bio-chemical process depends.

It was found that the presence of iron in the quantities employed (5 to 10 ppm.) stimulated the growth of the common sewage organism of *Aer. aerogenes*, and, after conditioning, increased the rate at which it reduced methylene blue (oxidized organic matter). A pure culture of aerogenes, fed intermittently with synthetic sewage and treated with ferric sulphate, developed an active sludge mass capable of performing the two functions of activated sludge, namely, of rapid adsorption of soluble organic matter and of oxidation at a much higher rate than that normally associated with that organism in the Bio-chemical oxygen demand reaction.

In the presence of a mixture of activated sludge in pure culture and the iron floc, not activated, adsorption goes largely to the iron floc to such an extent that the activated sludge is prevented from performing its ordinary oxidizing function. Given a continuous supply of normal sewage bacteria, the conditioning of the Bio-chemical sludge is rapid, two or three days being adequate to bring it up to equilibrium with sewage of 200 ppm. Bio-chemical oxygen demand, and to build up a mixed liquor of 1,000 ppm. suspended solids.

This Bio-chemical sludge will, therefore, become established in preference to the activated sludge and will tend to restrain the development of the latter under the designated operating conditions. This ability to adsorb more rapidly, together with the coagulating action of the freshly applied chemical, gives it an advantage over the slower acting sludge, which is reflected in practice in a reduced time requirement for aeration and consequent indicated economies in tank volume and in air.—EARLE B. PHELPS, *professor of sanitary science, Columbia University*, and JOHN G. BEVAN, *Guggenheim Bros., New York City.*

SEWAGE TREATMENT AND DEFENSE

An immediate problem that faces treatment plant operators in connection with the national defense program is the possible adverse effect of new or increased discharges of sewage or industrial wastes. The character of industrial wastes may be such as to interfere with treatment plant operation, especially if the plant includes sludge digestion facilities. The efficiency of chlorine disinfection may be reduced by industrial wastes with excessive chlorine demands. Treatment of wastes from defense industries before discharge into sewers or exclusion of such wastes from public sewers may be necessary.

Sewage disposal systems are particularly susceptible to damage from present-day war methods and their interruption may have serious detrimental consequences to the public health. Adequate defense requirements therefore call for careful checking of personnel, inauguration of protective measures against sabotage, a study of the possible effects of war damage, the adoption of safeguards against the effects of power interruption, the provision of duplicate equipment and supplies, emergency methods of treatment plant operation, emergency repair of sewers, and health precautions after flooding with sewage or contaminated water.

In case of a power breakdown with consequent failure of sewage treatment facilities it may become necessary to bypass the treatment plants. Under such conditions the chlorination facilities should be operated to disinfect the raw sewage heavily before it is discharged to any water course. Comparatively good over-all disinfection can thus be secured and this is a worth-while step toward health protection.

Judging from the limited reports of conditions abroad, breaks in sewers have been one of the principal sources of trouble in connection with aerial assaults. The repair of such breaks may involve use of emergency pumping facilities whereby the sewage is temporarily pumped overground from a manhole above the break to a manhole below the break. If there is a water course or storm sewer nearby, it might be possible temporarily to bypass sewage into either one of them.—WARREN J. SCOTT, *director of sanitary engineering, Connecticut State Department of Health.*

Crib Wall Model Tests Indicate New Design Assumptions Required

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Cable Guide Railing Construction Co., Inc.
Depew, New York

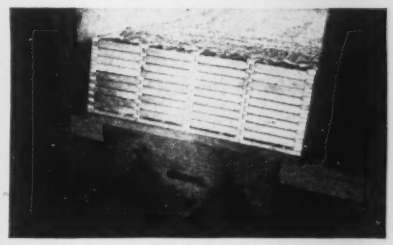
***Contents in Brief**—Lack of available information on crib wall design results in experiments which demonstrate that the common practice of designing these structures on a combination of retaining wall and bin theory is not applicable.*

To Develop Information on the reactions of crib walls under load, and to compare these data with similar facts on the behavior of standard gravity walls, a series of model tests have been made by the Cable Guide Railing Construction Co. Inc. The study was carried out using ordinary equipment and procedure, and is not reported as a "laboratory" type of investigation, but results indicate rather clearly that the common practice of designing crib walls on a combined assumption of retaining wall and bin theory is not applicable. The tests and results obtained are reviewed briefly in the following paragraphs.

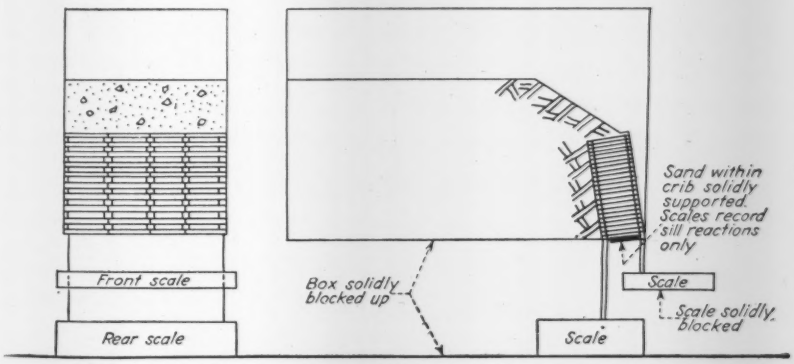
The tests were prompted by a set of engineering plans and specifications covering a reinforced concrete crib wall in which the design was based on a combination of retaining wall and bin theory. Actual experience of this company in the construction of reinforced concrete crib walls extending over many years indicated that this theory was not strictly applicable, since several walls with a proportion of 6 ft. base width to 24 ft. height have withstood years of service with no indication of instability.

A search of available literature indicated that no information was available on laboratory experiments relating to crib wall design, and the result was a decision to build and study some models in an attempt to determine the character of the action of both fill and backfill on concrete crib walls. The model consisted of a wooden box 29 in. wide across the face and 48 in. high (see drawing) in which the crib model was set up on the front face. Slots were cut in the floor of this box and rigid struts were used to carry the load from the front and rear sills of the model to platform scales. The fill occupying the space between the sills rested on a solid support.

The unit of the model crib was constructed out of wood and aluminum and the gravity wall model was built of concrete. Dry sand and broken stone were used for the fill. The closed face type of crib design was used in the tests.



Set-up for crib wall model tests indicating the method of measuring only the sill reactions.



Model crib wall under load test showing the backfill material of sand and crushed rock, and the support for measuring the front sill load.

In carrying out the tests the crib walls were built up and the box fill placed in 2 in. increments. This vertical dimension represented two lifts on the units of the crib. Reactions, as measured by the scales recording the load on the two sills were read at 6, 10, 15 and 20-in. heights of fill. Reactions were also read for a surcharge as it was added using 1½ to 1 slope. In the testing of the gravity wall model, the backfill was placed slowly and the reactions read for the same heights as used in the crib model.

Test different batters

The tests were conducted using batters of 1, 2, 3, and 4 in. per foot of crib height. The batter of 2 in. per foot was taken as the steepest practicable for heights of more than 10 ft. and the majority of tests were conducted on this type of crib wall. The tests indicated that the load distribution was approximately equal for both front and rear sills for the full 20-in. height of fill applied to the model. Dry sand was used, having an angle of repose of 1½ to 1, and this material was assumed to give maximum reaction.

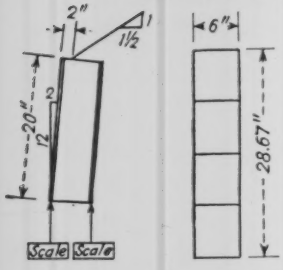
It is agreed that saturated clay would produce a maximum overturning moment, but crib walls are intended to sustain pervious fills and similar backfill material immediately behind them. This is comparable to a design assumed for solid concrete retaining walls with their drains and weep holes.

It was noticed during the test that there was an appreciable reduction of load on the sill front after settlement had taken place, and there was a small increase in the load on the rear sill, indicating that the maximum load and the maximum overturning moment was attained during construction of the crib wall.

The test results obtained in a series of five trials on the wall with the 2-in. batter are indicated in the accompanying table. This type of model had cross members running normal to the sills. A second type with cross members running at 60 deg. to the sills was tested and produced loads very close to the results shown in the table.

Following the test on the crib wall the gravity concrete wall model was

TEST RESULTS ON MODEL CONCRETE CRIB WALL SHOWING LOAD DISTRIBUTION ON SILLS



Ht. of wall and backfill	Weight on Scales in lb. Trial 1 Front	Trial 1 Rear	Trial 2 Front	Trial 2 Rear	Trial 3 Front	Trial 3 Rear	Trial 4 Front	Trial 4 Rear	Trial 5 Front	Trial 5 Rear	Average Front	Average Rear	Total	Rear
6"	12	18½	15½	23	14½	25	10½	18	10½	24	13	22		
10"	31½	33	33½	49	39½	47	25½	33	21½	41	30	41		
15"	52½	60½	64½	72	70	82	42½	59	39½	74	54	69		
20"	93½	73½	105	102	104	109	74½	98	65½	92	88	95		
16 hrs. later	71½	80½												
10" surchg	152½	54½	175½	73	160	92	134½	83	120½	67	149	74		
1 hr. later					143	96								
15" surchg	170½	50½	189½	68	157	91	141½	84	136½	56	159	70		
16 hrs. later									106½	70				
160 # superimposed							164½	74	129½	63				

placed in position and the backfill applied. This model had a batter of 1 in. to the foot, a bottom width of 6 in. and a top width of 1½ in. for the 20 in. height. Reactions were measured at the toe and the heel of the model wall. When the backfill reached the 20 in. level (top of the wall elevation), the top of the model had been moved out 1⅛ in. Further, when the surcharge load was added the wall moved out so far that results were meaningless except to indicate that this type of wall was not stable for the service simulated by the test.

Gravity wall model

As a second step in the testing of a gravity wall model, a specimen with an 8 in. base was then set up and subjected to similar loading. With a 20 in. height of backfill, both the top and bottom of the model moved out and continued to move under surcharge loading. The reduction of the load on the toe of the wall after time for settlement (16 hours) was not as appreciable as in the crib wall test. The theoretical load distribution for the wall (sand at 105 lb. per cu.ft. and an angle of repose of 1½ to 1) indicated a resultant which fell outside of the middle third.

The reactions of the 2 in. per foot batter crib in the gravity wall model are indicated in the accompanying drawing.

As a concluding step in the study, the effect of surcharge on walls of 6, 10 and 20-in. heights was measured. The results indicate that there was an increased reaction on the front sill due to equal surcharge loading as the height of the wall was increased.

A final test was made to determine the proportion of the total weight of sand and cribbing within the crib wall which was transferred to the foundation through the two sills. For this test a ¼ in. piece of plywood was attached to the back face of the rear stretcher to hold the sand from spilling out and the crib was then filled. Results indicated that 46 per cent of the total weight of sand and cribbing was transferred to the foundation through the sills. After deducting the weight of the cribbing from this total the remaining weight indicated that 38 per cent of the weight of sand was transferred through the rear sills, 62 per cent resting directly on the subgrade with no sand load indicated on the front sill.

Two tests were made on double bay sections with the rear bay carried up to a height of 10 in. and the front bay continued to the total 20 in. height of the model. The loading was level at 20 in. and the sill loads were distributed approximately as follows: front sill, 45 per cent; middle sill, 40 per cent, and the rear sill 15 per cent.

A further test was made on a 20-in. high crib, batter 2 and 12 in., with level backfill, without dowels or lugs to restrain stretchers from moving outward, and failed to show any such outward movement of the lower face stretchers, indicating very little horizontal thrust, as the friction of the members was sufficient to hold them in place.

Results and conclusions

The limitations of these studies are recognized and the following summary is not intended to be conclusions reached after an exhaustive investigation, but are merely an effort to interpret the results obtained in the foregoing tests.

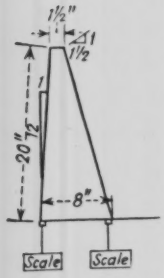
The model tests would seem to indicate that retaining wall theory cannot be applied to crib walls and that the overturning moment on a crib wall is not as high as in the standard design of gravity wall of the same height and sustaining the load from a similar backfill. The reactions indicated that the crib wall was not subject to overturning effect until the surcharge loads were applied.

The tests conducted to determine the load which was carried on the bottom headers acting as beams was carried out by supporting the sills and cutting slots in the bottom of the box so that only the reactions of the header (independent of the sills and stretchers) would be recorded on the scale. The results of four tests indicated that there was no load carried on the header discernible on the scales reading to ½ lb.

The results seem to indicate that horizontal pressure in the stretcher units cannot be computed by the theory of pressure in deep bins. Construction practice of a period of 20 years bears this out.

In conclusion, the tests made indicate to a great extent the flexibility of concrete cribbing and its great stability in comparison with gravity section concrete walls of equal base width. From the standpoint of economy, increased use of cribbing should be obvious.

TEST ON MODEL CONCRETE GRAVITY WALL



Height of Backfill	Weight on Scales in lb. Trial 1 Toe	Trial 1 Heel	Trial 2 Toe	Trial 2 Heel	Average Toe	Average Heel
0	125½	95	120½	98	123	96½
6"	132½	99	123½	104	128	101½
10"	150½	94	141½	97	146	95½
15"	179½	92	175½	89	177½	90½
20"	262½	54	252½	47	257½	50½
20"	Top out ¼"		Top out ⅜"			
20"	Bot. out ⅛"		Bot. out ¼"			
16 hr. later			247½	54		
6" Surchg.	313	29	324	15	319	21
	Top out ½"		Top out ⅞"			
	Bot. out ⅜"		Bot. out ½"			

BUILDING DESIGNERS' LIBRARY

Designing to Save Steel

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***Contents in Brief**—In light of the current shortage of steel, structures, both reinforced-concrete and steel frame, can be designed to save considerable steel over that required for usual designs, principally by increasing the depth of construction. Examples show steel savings up to 28 percent. Total costs may be higher, but for the duration of the existing steel situation may be considered justified.*

CAN A BUILDING, either concrete or steel frame, be designed to use less steel, thereby providing more steel for defense needs? Will such design cost more? Will use of less steel affect the design to extent of handicapping usefulness of the project? How much steel can be saved by careful planning and designing?

These questions are naturally raised by the current shortage of steel and steel products created by the defense program. Careful thought and an analysis of several possible types of design bring forth suitable answers.

Buildings can be designed to use less steel. Total costs may or may not be increased, but probably will be to a certain extent. By careful planning all requirements should be fulfilled without seriously impairing the efficiency of the structure. Finally, the amount of steel saving possible depends upon many local conditions, though investigation of several possible designs show savings from 12 to 28 percent.

It is obvious that saving of steel depends upon the scheme of framing adopted, clearance required, spans, loads, depth of construction, unit stresses and the requirements of the locality where the project is to be built. It is apparent, however, that for a given set of conditions, with concessions allowed for the increase of the depth of construction and column sizes, a considerable saving of steel can be realized.

The author wishes to stress the point that the observations made herein are in consideration of the current shortage of steel. The sole idea is to save steel, not to produce the cheapest or most efficient structure. Actually, in normal times with ample steel available, lower total costs and higher efficiency of structure can usually be obtained by using more steel.

Structural steel frames

For steel frame structures, perhaps the most obvious saving in steel for floor construction is effected by the use of the "most economical section," known to all designers. It is to be observed, however, that in many structures clearances are not sufficient to permit use of the most economical section, resulting in an excess of steel varying from a small amount to as much as 50 percent. For example, a 16-in. 40-lb. wide flange beam will resist the same loading as a 14-in. 48-lb. beam, a 12-in. 50-lb. beam or a 10-in. 60-lb. beam, the latter being used for special conditions only. Small increases in the depth of construction, such as 2, 4, or 6 in. only, can readily be recognized as a means to effect considerable saving of the structural steel tonnage for most projects.

In the selection of steel column shapes, steel saving is usually available by using the shape with the widest flange, and this fact is more pronounced for greater story heights. Obviously, also, tonnage in a steel-frame building varies with dead weight, therefore steel saving is reflected in dead weight saving.

To meet the present emergency, consideration might be given to the rolling of fewer of the wide flange sections. Of the total of 183 wide flange sections listed in steel catalogs and stock lists, 43 form the most economical section group for floorbeams and girders, and about 50 to 60 other sections provide ample selection for column loading requirements. The final selection of rolled sections to be made available could be determined at a conference of representatives of structural engineering firms, steel producers, fabricators and distributors. The adoption of the 43 sections of the most economical section group for beams and girders should tend to bring about a steel saving, although such a curtailment may mean deeper floor construction and less vertical clearances. Any list of column sec-

Design assumptions

Designed in accordance with A.C.I. Building Code of 1936. Basis: Seven typical interior framed areas and seven stories of typical interior column with footing. Story height: 10 ft. clear under girders. For quantities the seven framed areas were considered identical.

Live loads:
- Floor: 100 lb. per sq. ft. with 15-percent reduction on girders.
- Columns and footing: Roof imposed load, 53 lb. per sq. ft., top floor live load, 85 lb. per sq. ft. with 5-percent reduction for each successive floor below.

Slabs, beams and girders: Designed for clear spans and on basis of positive and negative moments of $0.083\ w l^2$.

Reinforcing:
- Straight bars in floor extend to center line of support; bent bars extend to quarter-point of adjacent clear spans.
- All bars in floor and footing bottom either intermediate grade billet or rail steel.
- Vertical bars in columns either rail or hard grade steel, with lapped splices above floors and footing.
- Dowel embedment: 40 bar diameters for 2,000-lb. concrete; 30 diameters for 3,000-lb. concrete.
- Column spirals assumed as cold-drawn wire with lengths equal to clear story height.

Footing soil pressure, 4,000 lb. per sq. ft.
Top of footing 1 ft. below basement floor.
Hand excavation assumed below top of footing and 6 in. clear around footing.

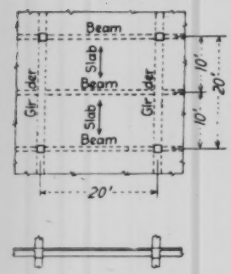
Assumed unit costs

Reinforcing steel in place:
- Slab bars, column spirals, $6.00 per cwt.
- Other bars, $4.50 per cwt.

Concrete in place:
- 2,000-lb. concrete, 35c. per cu. ft.
- 3,000-lb. concrete, 37c. per cu. ft.

Forms: 20c. per sq. ft.
Hand excavation: 5c. per cu. ft.

STEEL SAVING ILLUSTRATIONS FOR REINFORCED CONCRETE DESIGNS



Plan and Section for Typical Interior Panel

SLAB AND BEAM SCHEDULES

Scheme No. & Conc. Ult. Str.	Element	Size	Reinforcing
1 and 2 — 2,000 lb. per sq. in.	Slab	4½"	⅜" rd. @ 5½", alt. st. and bt., ⅜" rd. @ 16½", Shrink. bars
	Beam	8×24½	1-1" rd. st., 1-1" rd. bt., 16-⅜" rd. Stirr., 7@ 11" ea. end
	Girder	17×26½	3-⅞" rd. st., 3-⅞" rd. bt., 19-⅜" rd. Stirr. @ 12"
3 and 4 — 3,000 lb. per sq. in.	Slab	4"	⅜" rd. @ 5", alt. st. and bt., ⅜" rd. @ 18", Shrink. bars
	Beam	8×20	1-1" sq. st., 1-1" sq. bt., 18-⅜" rd. Stirr., 8@ 8" ea. end
	Girder	17×21	2-1" sq. st., 2-1" sq. bt., 20-⅜" rd. Stirr., 9@ 8" ea. end
5 — 3,000 lb. per sq. in.	Slab	5"	⅜" rd. @ 6", alt. st. and bt., ⅜" rd. @ 14½", Shrink. bars
	Beam	7½×26	1-1" rd. st., 1-1" rd. bt., 12-⅜" rd. Stirr., 5@ 11" ea. end
	Girder	9½×28	1-1¼" sq. st., 1-1¼" sq. bt., 19-⅜" rd. Stirr. @ 12"

COLUMN AND FOOTING SCHEDULES

Conc. Ult. Str.	2,000 lb. per sq. in.		3,000 lb. per sq. in.		
Scheme No.	1	2	3	4	5
Columns, % Vert. Steel	1 % min	1 % min. to 3.7 % max.	1 % min.	1 % min. to 3.9 % max.	1 % min.
Story	Col. Size & Verts. Ties or Spiral	Col. Size & Verts. Ties or Spiral	Col. Size & Verts. Ties or Spiral	Col. Size & Verts. Ties or Spiral	Col. Size & Verts. Ties or Spiral
Roof					
6th Fl.	12" sq., 4-¾" rd. ¼" rd. Ties @ 12"	12" sq., 4-¾" rd. ¼" rd. Ties @ 12"	12" sq., 4-¾" rd. ¼" rd. Ties @ 12"	12" sq., 4-¾" rd. ¼" rd. Ties @ 12"	12" sq., 4-¾" rd. ¼" rd. Ties @ 12"
5th Fl.	16" sq., 6-¾" rd. 13" sp., ⅜" rd. @ 2"	16" sq., 6-¾" rd. 13" sp., ⅜" rd. @ 2"	16" sq., 6-¾" rd. ¼" rd. Ties @ 12"	16" sq., 6-¾" rd. ¼" rd. Ties @ 12"	16" sq., 6-¾" rd. ¼" rd. Ties @ 12"
4th Fl.	18" sq., 6-⅞" rd. 15" sp., ⅜" rd. @ 2½"	16" sq., 6-1" rd. 13" sp., ⅜" rd. @ 2"	16" sq., 6-¾" rd. 13" sp., ½" rd. @ 2"	16" sq., 6-¾" rd. 13" sp., ½" rd. @ 2"	16" sq., 6-¾" rd. 13" sp., ½" rd. @ 2"
3rd Fl.	21" sq., 6-1" rd. 18" sp., ⅜" rd. @ 2"	16" sq., 6-1¼" sq. 13" sp., ⅜" rd. @ 2"	18" sq., 6-⅞" rd. 15" sp., ½" rd. @ 2½"	16" sq., 6-1" rd. 13" sp., ½" rd. @ 2"	18" sq., 6-⅞" rd. 15" sp., ½" rd. @ 2½"
2nd Fl.	23" sq., 6-1" sq. 20" sp., ⅜" rd. @ 2"	18" sq., 7-1¼" sq. 14" sp., ⅜" rd. @ 2¼"	20" sq., 6-1" rd. 17" sp., ½" rd. @ 2¼"	16" sq., 6-1⅛" sq. 13" sp., ½" rd. @ 2"	20" sq., 6-1" rd. 17" sp., ½" rd. @ 2¼"
1st Fl.	26" sq., 7-1" sq. 23" sp., ⅜" rd. @ 2"	20" sq., 8-1¼" sq. 17" sp., ⅜" rd. @ 2¼"	21" sq., 6-1" rd. 18" sp., ½" rd. @ 2½"	17" sq., 6-1¼" sq. 14" sp., ½" rd. @ 2¼"	22" sq., 6-1" sq. 19" sp., ½" rd. @ 2½"
Bsmt. Fl.	28" sq., 8-1" sq. 25" sp., ½" rd. @ 3½"	22" sq., 9-1¼" sq. 19" sp., ⅜" rd. @ 2"	23" sq., 7-1" rd. 20" sp., ½" rd. @ 2½"	18" sq., 8-1¼" sq. 15" sp., ½" rd. @ 2½"	24" sq., 6-1" sq. 21" sp., ½" rd. @ 2½"
Dowels	8-1" sq.	9-1¼" sq.	7-1" rd.	8-1¼" sq.	6-1" sq.
Footing Size	11'-9" sq. × 3'-0"	11'-8" sq. × 2'-6"	11'-2" sq. × 3'-0"	11'-2" sq. × 2'-0"	11'-8" sq. × 3'-0"
Monol. cap	3'-6" sq. × 1'-1"	5'-8" sq. × 1'-11"	None	4'-4" sq. × 1'-5"	None
Bars, ea. way	28-⅝" rd.	37-⅝" rd.	25-⅝" rd.	45-⅝" rd.	29-⅝" rd.

TABLE OF UNIT QUANTITIES AND ITEM COSTS
AVERAGE PER SQUARE FOOT OF FRAMED FLOOR AREA

Concrete Ult. Strength	2,000 lb. per sq. in.				3,000 lb. per sq. in.					
Scheme Number	1		2		3		4		5	
Columns, % Vert. Steel	1 % min.		1 % to 3.7 %		1 % min.		1 % to 3.9 %		1 % min.	
Item	Unit Quan.	Item Costs $	Unit Quan.	Item Costs $	Unit Quan.	Item Costs $	Unit Quan.	Item Costs $	Unit Quan.	Item Costs $
Reinforcing Steel										
Slab	1.250	0.075	1.250	0.075	1.305	0.078	1.305	0.078	1.125	0.067
Beam & Girder	1.730	0.078	1.730	0.078	1.977	0.089	1.977	0.089	1.532	0.069
Column, Vert. Dowel & Ties	0.689	0.031	1.240	0.056	0.460	0.021	0.835	0.038	0.525	0.024
Column Spirals	0.237	0.014	0.145	0.009	0.252	0.015	0.238	0.014	0.260	0.015
Footing	0.256	0.012	0.331	0.015	0.220	0.010	0.395	0.018	0.262	0.012
Total lbs. per sq. ft.	4.162		4.696		4.214		4.750		3.704	
Total cost per sq. ft.		0.210		0.233		0.213		0.237		0.186
Concrete										
Slab, Beam & Girder	0.604		0.604		0.510		0.510		0.622	
Column	0.092		0.063		0.068		0.053		0.073	
Footing	0.152		0.145		0.135		0.100		0.147	
Total cu. ft. per sq. ft.	0.848		0.812		0.713		0.663		0.842	
Total cost per sq. ft.		0.297		0.284		0.264		0.245		0.312
Forms										
Slab (overall)	1.000		1.000		1.000		1.000		1.000	
Beam & Girder Bottoms	0.127		0.127		0.127		0.127		0.098	
Beam & Girder Sides	0.480		0.480		0.380		0.380		0.513	
Column	0.172		0.142		0.150		0.132		0.160	
Footing	0.055		0.058		0.047		0.040		0.050	
Total sq. ft. per sq. ft.	1.834		1.807		1.704		1.679		1.821	
Total cost per sq. ft.		0.367		0.361		0.341		0.336		0.364
Hand Excavation										
Total cu. ft. per sq. ft.	0.210		0.253		0.162		0.180		0.017	
Total cost per sq. ft.		0.011		0.013		0.008		0.009		0.009
Grand Total Cost per sq. ft.		$0.885		$0.891		$0.826		$0.827		$0.873
Summary of Reinforcing Steel Saving, Lbs.										
Excess, each scheme over No. 5, lbs. per sq. ft.	0.458		0.992		0.510		1.046		—	
Saving by adopting Scheme No. 5, percent	12 %		27 %		14 %		28 %		—	
Excess, No. 2 over No. 1, lbs. per sq. ft.	—		0.534		—		—		—	
Saving by adopting No. 1 instead of No. 2, %	—		13 %		—		—		—	
Excess, No. 4 over No. 3, lbs. per sq. ft.	—		—		—		0.536		—	
Saving by adopting No. 3 instead of No. 4, %	—		—		—		13 %		—	

tions provides many sections suitable for use as beams outside the most economical section beam and girder group. There is ample room for selection of a most suitable section group for columns only to meet the present emergency.

Steel saving in a structural steel frame can also be brought about by the use of reinforced-concrete beams for miscellaneous framing not required for erection purposes, use of higher unit stresses under steel base plates bearing on concrete, use of the composite beam where floors are of concrete and the beam encased in concrete, use of coverplates on beams or built-up girders, and the use of stiffened thin plates.

Reinforced concrete

In reinforced concrete structures steel saving can be effected by the simple process of increasing the depth of construction. Also, the use of a higher ultimate-strength concrete contributes toward the lessening of the dead load, the thinning of beams of a given depth, the reduction in the size of the columns, and some minor factors such as length of steel embedment for splices and dowels, and higher unit bond and shear stresses, all of which are reflected in steel saving figures.

In an analysis of thirteen studies of a typical concrete frame (five of which are presented in the accompanying table) efforts were made to find the most reasonable means for the designer to save steel at the least increase in total cost. The following is a summary of facts found:

1. Increase the slab thickness; allowing for increase in shrinkage steel and the increase in dead load to the rest of the structure, an increase in thickness of 1 in. over that required is suggested.

2. Modify beam and girder depths slightly to make full use of a smaller steel area.

3. Select columns on a minimum percent of steel basis; compared with a percentage ranging up to the maximum for the lower stories, this expedient shows a consistent saving of steel for either 2,000 or 3,000-psi. concrete, and with only slight variations in costs; in the illustrations given the saving is about 13 percent.

4. Design footings to provide about 0.2 percent steel.

5. Use of a design involving slabs 1 in. thicker than required, beams and girders 20 to 40 percent deeper than usually adopted, columns selected on a 1-percent minimum basis for the vertical steel, and footings on an 0.2-percent basis, will result in noticeable savings; and by the use of a higher ultimate-strength concrete, steel saved runs up to 25 or more percent, without unreasonable increase in total costs. In the accompanying tables, design scheme No. 5 shows the greatest saving, schemes No. 2 and 4 the least.

From Field and Office

Working problems and time-saving methods for engineers and contractors

Table of Fixed-End Moments

Determination of the fixed-end moments due to a uniformly varying load that covers only a part of the span is a problem often encountered in designing hydraulic structures and aircraft, and occasionally even in the design of bridges and buildings. In their book, "Continuous Frames of Reinforced Concrete," Professors Cross and Morgan suggest that fixed-end moments in prismatic beams subjected to partial loadings be obtained by temporarily introducing a false reaction or by integration. Although these methods are straightforward, the computations may become lengthy, and it is advantageous to have a table giving values of the fixed-end moments in terms of the dimensions and magnitude of the span and loading. A short table of this kind in the "Design Data" of the U. S. Bureau of Reclamation suggested the arrangement of the table given herewith, computed by the writer, assisted by NYA students Keith Brayman and Normal Peterson.

To illustrate the use of the table, a beam 12 ft. long, carrying a load that varies uniformly from zero at the center of the span to 400 lb. per ft. at the quarter-point may be assumed. Referring to the table and its accompanying diagram, $a = 6$, $b = 3$, $l = 12$, and $w = 400$. Under $a/l = 0.5$ and $b/l = 0.25$, the table gives $C_L = 0.0924$ and $C_R = 0.1810$. The fixed-end moments therefore are

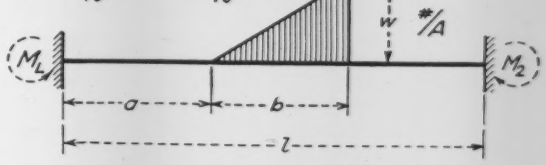
$$M_L = 0.0924 \times \frac{400 \times 144}{10} = 532 \text{ ft.-lb.}$$

$$M_R = 0.1810 \times \frac{400 \times 144}{10} = 1042 \text{ ft.-lb.}$$

Strictly speaking, the table applies only to prismatic beams, although the error from neglecting the small amount of variations of moment of inertia due to coverplates or additional reinforcing bars will ordinarily be inappreciable. Only when the depth varies will the effect of variations of moment of inertia have to be evaluated.—C. J. Posey, *associate professor of hydraulics and structural engineering, State University of Iowa.*

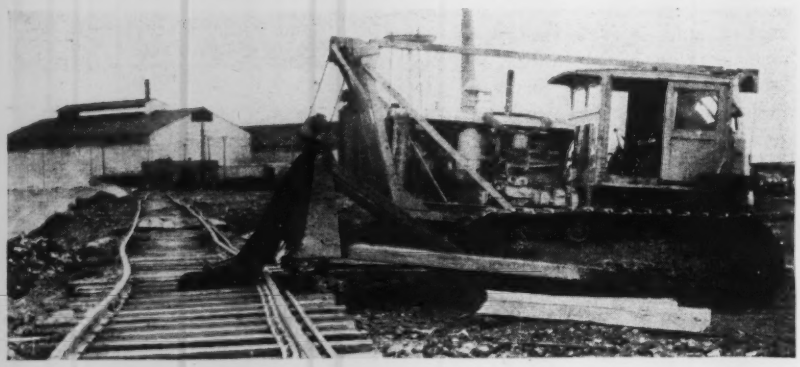
FIXED-END MOMENTS FOR HYDROSTATIC-TYPE LOADINGS ON PRISMATIC BEAMS

Values of b/l		Values of a/l																				
		0	0.05	0.10	0.15	0.20	0.25	0.30	0.35	0.40	0.45	0.50	0.55	0.60	0.65	0.70	0.75	0.80	0.85	0.90	0.95
0.05	C_L	.0077	.0174	.0250	.0305	.0342	.0363	.0370	.0364	.0348	.0322	.0290	.0253	.0213	.0171	.0130	.0092	.0058	.0030	.0011	.0001
	C_R	.0003	.0016	.0039	.0069	.0104	.0144	.0185	.0226	.0266	.0302	.0332	.0354	.0367	.0369	.0358	.0332	.0289	.0227	.0145	.0040
0.10	C_L	.0285	.0451	.0574	.0661	.0714	.0736	.0733	.0707	.0662	.0602	.0531	.0453	.0370	.0288	.0209	.0138	.0079	.0034	.0008		
	C_R	.0023	.0062	.0117	.0185	.0261	.0343	.0426	.0506	.0580	.0644	.0694	.0727	.0738	.0724	.0682	.0607	.0496	.0345	.0150		
0.15	C_L	.0591	.0798	.0947	.1043	.1092	.1100	.1072	.1015	.0933	.0832	.0718	.0597	.0473	.0354	.0244	.0148	.0074	.0026			
	C_R	.0074	.0149	.0244	.0354	.0474	.0597	.0718	.0832	.0933	.1015	.1073	.1100	.1092	.1043	.0947	.0798	.0592	.0321			
0.20	C_L	.0965	.1190	.1342	.1429	.1459	.1438	.1375	.1277	.1152	.1007	.0849	.0686	.0525	.0375	.0242	.0134	.0059				
	C_R	.0168	.0285	.0425	.0579	.0741	.0903	.1058	.1198	.1315	.1402	.1451	.1456	.1408	.1300	.1125	.0874	.0541				
0.25	C_L	.1380	.1602	.1739	.1801	.1798	.1738	.1632	.1488	.1316	.1125	.0924	.0724	.0533	.0361	.0217	.0111					
	C_R	.0313	.0476	.0662	.0860	.1061	.1257	.1436	.1590	.1710	.1787	.1810	.1771	.1659	.1467	.1184	.0801					
0.30	C_L	.1812	.2013	.2120	.2144	.2097	.1990	.1835	.1641	.1422	.1188	.0949	.0719	.0507	.0325	.0184						
	C_R	.0513	.0725	.0955	.1194	.1428	.1647	.1841	.1996	.2103	.2150	.2125	.2019	.1818	.1512	.1091						
0.35	C_L	.2240	.2404	.2468	.2444	.2346	.2187	.1979	.1737	.1473	.1200	.0931	.0680	.0459	.0282							
	C_R	.0772	.1030	.1302	.1573	.1832	.2064	.2257	.2397	.2472	.2468	.2372	.2171	.1852	.1402							
0.40	C_L	.2645	.2761	.2772	.2693	.2539	.2324	.2065	.1776	.1472	.1168	.0879	.0619	.0405								
	C_R	.1088	.1389	.1595	.1991	.2261	.2492	.2668	.2774	.2795	.2715	.2521	.2197	.1738								
0.45	C_L	.3014	.3072	.3022	.2883	.2671	.2402	.2094	.1764	.1428	.1103	.0806	.0554									
	C_R	.1458	.1794	.2125	.2432	.2701	.2913	.3053	.3102	.3044	.2863	.2541	.2061									
0.50	C_L	.3333	.3326	.3212	.3011	.2742	.2422	.2071	.1707	.1350	.1018	.0729										
	C_R	.1875	.2236	.2579	.2884	.3133	.3307	.3388	.3355	.3192	.2878	.2396										
0.55	C_L	.3595	.3518	.3339	.3077	.2754	.2389	.2003	.1618	.1253	.0929											
	C_R	.2329	.2703	.3043	.3328	.3537	.3650	.3646	.3504	.3205	.2726											
0.60	C_L	.3792	.3646	.3402	.3083	.2712	.2311	.1902	.1508	.1152												
	C_R	.2808	.3179	.3498	.3742	.3888	.3914	.3798	.3517	.3048												
0.65	C_L	.3922	.3708	.3404	.3035	.2625	.2199	.1781	.1396													
	C_R	.3296	.3646	.3922	.4102	.4159	.4071	.3811	.3357													
0.70	C_L	.3985	.3707	.3350	.2940	.2504	.2068	.1658														
	C_R	.3773	.4081	.4292	.4381	.4321	.4087	.3651														
0.75	C_L	.3984	.3649	.3248	.2810	.2363	.1934															
	C_R	.4219	.4490	.4580	.4549	.4341	.3926															
0.80	C_L	.3925	.3544	.3112	.2660	.2219																
	C_R	.4908	.4756	.4755	.4573	.4181																
0.85	C_L	.3817	.3402	.2955	.2508																	
	C_R	.4915	.4939	.4784	.4416																	
0.90	C_L	.3672	.3239	.2794																		
	C_R	.5103	.4974	.4630																		
0.95	C_L	.3505	.3074																			
	C_R	.5144	.4825																			
1.00	C_L	.3333																				
	C_R	.5000																				

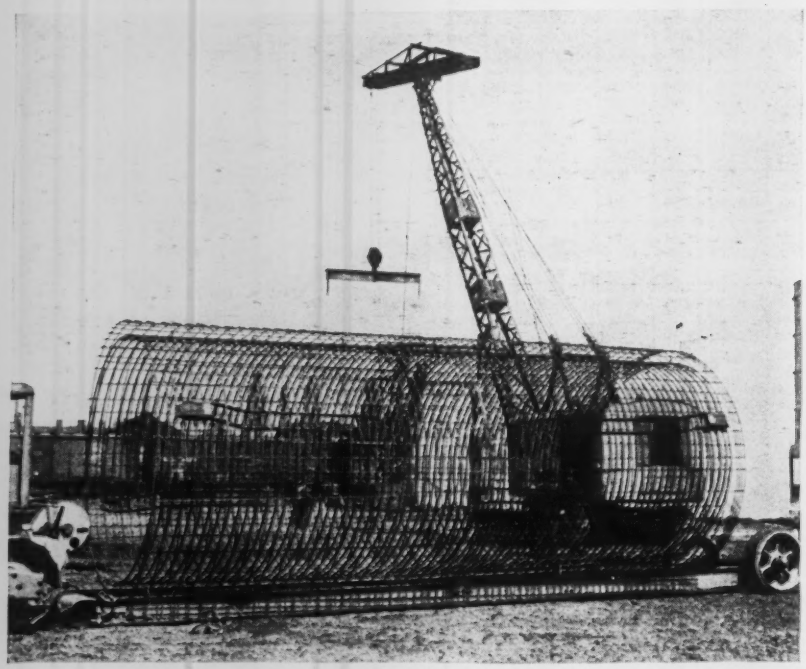


Tractor Shifts Railway Track

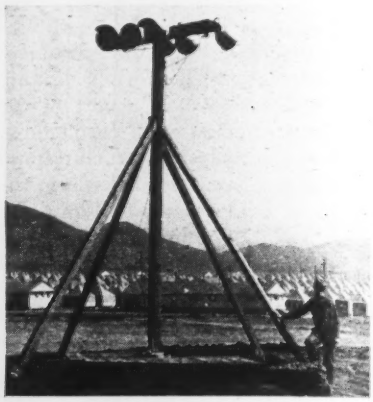
Great saving of track-moving labor is accomplished at the works of the Timken Roller Bearing Co. by a tractor bulldozer fitted with the lifting and pulling attachment illustrated. This attachment is made of two torch-cut 1-in. plates set parallel and welded to cross-spacers. The tops of the plates are cut to hook tightly over the top of the bulldozer blade. Two dogs and a hook, which runs back under the blade, make the bottom of the attachment secure. In operation the tractor moves ahead to hook the device under the far rail and lift and drag the track toward the edge of the dump or it backs so that the device bears against the near rail and the track is pulled inward. As used at the Timken steel mill dump it is estimated that 1 hr. of tractor work equals 96 hr. of hand labor when working on the level and 120 hr. when moving track uphill. The device is not manufactured by the Timken company; it is described here as a service to contractors or others who have track shifting to do. Any well outfitted machine shop can make the device. As used at the Timken mills, it is fitted to a diesel crawler-tractor bulldozer.



Tractor bulldozer with track-moving attachment.

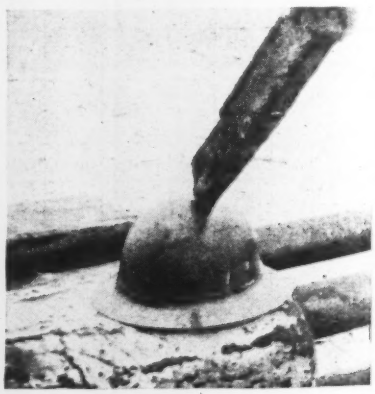


***TRACTOR** with winch hauls reinforcing steel cage in casting yard for 108-in. subaqueous concrete pipe for Toledo new Lake Erie water supply project. The carrier consists of a toboggan-nosed skid of 10-in. I-beams with axle at the rear end.*



SLED CARRIES FLOODLIGHTS

***MUD CONDITIONS** at Camp San Luis Obispo, Calif., made it desirable to mount the floodlight standards on sleds so that the floodlights could be moved conveniently about the job. Various arrangements were used; the one here shown is a battery of six 1,000-watt lamps, pointed two ways, supported on a sled 16 ft. square. Center post is a 6x6 and the four diagonals are 4x6-in. timbers. Sled runners are 8x8 and there is a 2-in. plank flooring over the center portion of the sled frame.*



HARD HAT—WHOLE HEAD

***A WORKMAN** of a piledriving crew on a U. S. Engineer job at Lewes, Del., was recently saved serious injury by his hard hat as illustrated above. A 7-lb. steel wedge fell 40 ft. and damaged only the man's headgear.*

Even when it "hits bottom"

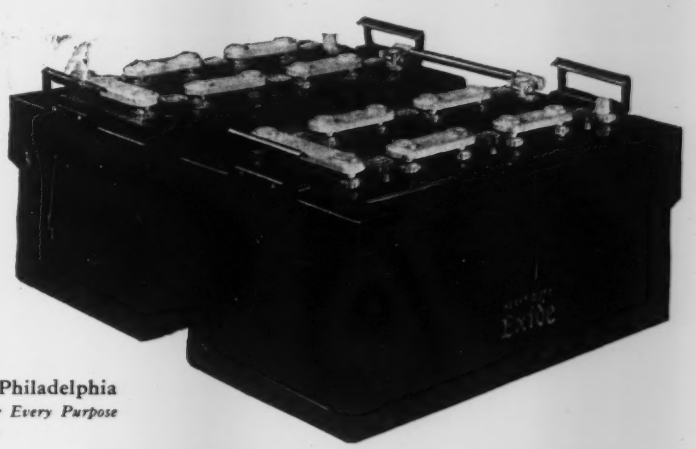
Exide Batteries crank Diesels *FAST!*

EVEN where blizzards howl and the mercury drops almost out of sight, Exide Batteries pour out the power needed to crank cold Diesel engines fast.

There's a good reason. Exide research engineers designed special batteries for cranking Diesel engines . . . then tested them in a laboratory cold room to be sure they would deliver a mighty flood of power at sub-zero temperatures, when oil has stiffened up . . . and above all deliver this power at the high voltage necessary for fast cranking.

Exide
BATTERIES
FOR CRANKING
DIESEL ENGINES

And there's plenty of *proof* that Exide Batteries do the job. From the Exides which cranked the Diesel engines of the Snow Cruiser in Antarctica, to the Exides in service at icy construction camps, and the Exides which are original equipment on 95% of all American Diesel-powered locomotives . . . these batteries have demonstrated their superb cranking ability in the coldest weather.



Also, Exides assure you of long, dependable service at low cost, with a minimum of maintenance. There is an Exide suitable for cranking every size and type of Diesel engine. Write us for full details today.

THE ELECTRIC STORAGE BATTERY CO., Philadelphia
The World's Largest Manufacturers of Storage Batteries for Every Purpose
Exide Batteries of Canada, Limited, Toronto

CONTRACT UNIT PRICES

What contractors are bidding on different kinds of construction work

MANHATTAN TUNNELS BROOKLYN-BATTERY TUNNEL

OWNER: New York City Tunnel Authority, New York, N. Y.; Alfred B. Jones, chairman; Ole Singstad, chief engr.

PROJECT: Construction of Manhattan Tunnels (Contract 6) of the Brooklyn-Battery Tunnel from the Manhattan construction shaft in Battery Park to points in East River northeast of Governor's Island. Approximate length 2,400 feet. Includes all tunnel excavation; furnishing and erecting light cast iron tunnel lining; erecting heavy cast iron lining furnished by the Authority; placing of concrete lining and interior construction inside metal tunnel lining; permanent roof and fill in Manhattan construction shaft; and removal of field office from present location and re-erecting in vicinity of shaft at Battery. It is necessary to protect, support and maintain all buildings, monuments, piers, wharves, bulkheads and other structures in vicinity during construction period.

CONDITIONS: Alternate methods of disposal of excavated material were permitted. Schedule A allowing disposal at place selected by contractor other than at Battery Park, and Schedule B allowing partial special disposal at the Park, and other disposition at place selected by contractor. Alternates were also allowed on tunnel lining, light cast iron (Schedule C), or structural steel (Schedule D). Award was made on basis of Schedules B and C, which are tabulated below. Other contracts may be started during the life of this one, and care must be taken by contractor not to interfere with them. Time for completion 37 calendar months. Wage rates in compressed air (18 lb. per sq.in.) range from $11.00 to $12.50 per six-hour day. Higher pressures increase base rate 50c. per day when pressure exceeds 18 lb. and may reach an additional $3.00 per day if pressure tops 48 lb. In free air minimum wage rates are: skilled labor, $1.40 to $2.25 per hr.; semi-skilled, 90c. to $1.60; and common, 87½c.

BIDS: Four bids were received September 16, 1941, ranging from the contract low of $13,948,619 to $15,890,741. (On basis of Schedules B, C and E).

LIST OF BIDDERS:

1. Mason & Hanger Co., Inc., New York, N. Y. ... $13,948,619
2. Seaboard Constr. Corp., Mt. Kisco, N. Y. ... 14,300,676
3. S. A. Healy Co., Inc., White Plains, N. Y. ... 15,604,110
4. Rosoff Tunnel Corp., New York, N. Y. ... 15,890,741

Schedule B—Tunnel Excavation, Including Special Disposal of it at Battery Park

Item	Quan.	Unit Prices (1)	(2)	(3)
1. Tun. excav. bet. Sta. 32+20 and 34+20 E. tunnel and Sta. 32+90 and 34+60 W. tunnel, incl. disp. select. by contr.	11,400 c. y.	$92.00	$136.56	$88.00
2. Tun. excav. north of Sta. 53+15 E. tunnel and 53+35 W. tunnel, incl. disp. at Battery Park, except as under Item 1	75,200 c. y.	33.50	27.95	42.25
3. Tun. excav., as above, at site selected by contractor, except as in Item 1	61,200 c. y.	34.50	29.20	43.00
4. Tun. excav., as above, except South of stations noted, incl. disp. at Park	12,300 c. y.	14.00	17.00	12.25
5. Tun. excav., as above, incl. disp. at place selected by contractor	12,300 c. y.	15.00	18.00	13.00

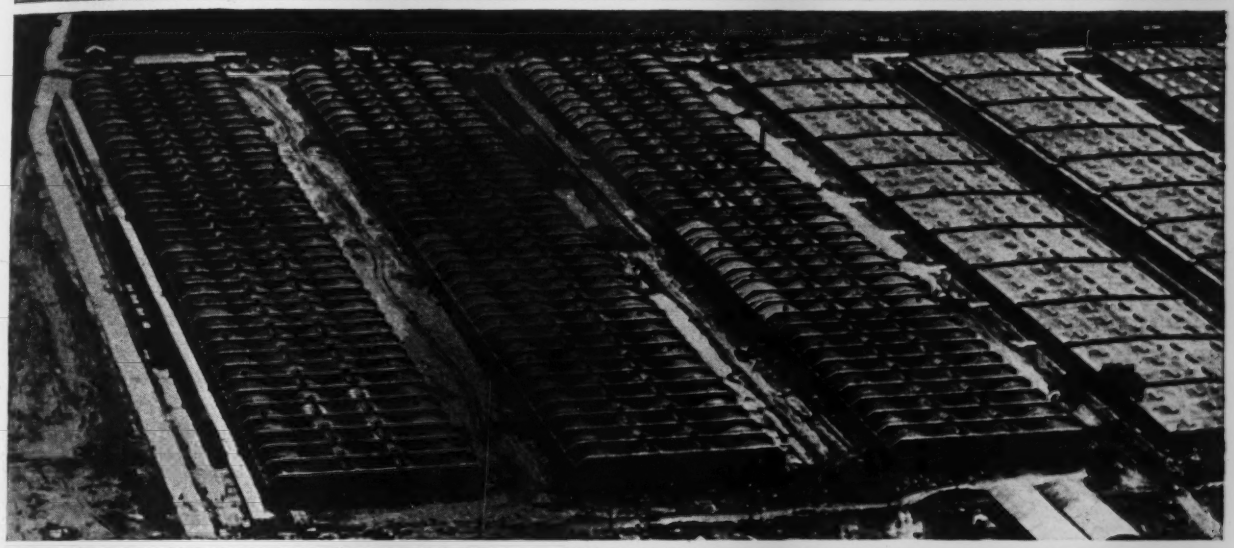
Schedule C—Light cast-iron tunnel lining

Item	Quan.	Unit Prices (1)	(2)	(3)
1. Cement used in concrete	72,700 bbl.	$3.00	$2.50	$2.80
2. Concrete, exc. cement, inside lt. and hvy. c. i. tun. lining, incl. inside cross-passage	47,200 c. y.	30.00	30.00	37.00
3. All other concrete, excl. cement	1,250 c. y.	30.00	30.00	33.75
4. Fill voids outside lt. c. i. tun. lining, north or stations noted	4,450 l. f.	125.00	143.00	79.00
5. As above, south of stations noted	850 l. f.	125.00	130.00	79.00
6. Str. steel conn. rings betwn. c. i. tun. lining and Manhattan constr. shaft	25 ton	700.00	500.00	440.00
7. Frames conn. lt. c. i. tun. lining to c. i. lining of cross-passage	20 ton	700.00	700.00	575.00
8. 1⅜-in. h. t. steel bolts for lt. c. i. tun. lining, north of stations noted	267,700 ea.	1.00	.80	.75
9. As above, south of stations noted	51,000 ea.	1.00	.75	.75
10. 1-in. h. t. steel bolts for 9-ft. c. i. tun. lining	650 ea.	.50	.50	.45
11. Furn. and del. 1⅜-in. h. t. steel bolts for lt. c. i. tunnel lining	249,000 ea.	.60	.50	.50
12. Furn. and del. 1-in. h. t. st. bolts for 9-ft. c. i. tun. lining	500 ea.	.30	.25	.25
13. Type B ceiling hanger units for lt. c. i. tun. lining	690 ea.	50.00	40.00	50.00
14. 31-ft. lt. c. i. straight rings, incl. 4 half "A" segments, north of sta. noted	19,000 ton	99.00	109.70	112.00
15. As above, taper rings, n. of sta. noted	1,820 ton	114.00	124.20	124.00
16. As above, c. i. transition rings	55 ton	154.00	164.60	165.00
17. 9-ft. c. i. stright rings, n. of sta. noted	15 ton	234.00	237.40	230.00
18. 31-ft. lt. c. i. straight rings, south of sta. noted	3,780 ton	99.00	105.00	112.00
19. As above, taper rings	200 ton	114.00	120.00	124.00
20. Special lt. cast iron closure rings	25 ton	334.00	300.00	285.00
21. Furn. and del. 31-ft. lt. c. i. straight rings, inc. 4 half "A" segements	17,250 ton	72.00	69.70	82.00
22. Furn. and del. 31-ft. lt. c. i. taper rings	2,120 ton	84.00	82.20	94.00
23. Furn. and del. 31-ft. c. i. transition rings	30 ton	120.00	119.60	130.00
24. Furn. and del. 9-ft. c. i. straight rings	12 ton	190.00	192.40	200.00
25. Special light c. i. closure rings	50 ton	250.00	254.80	255.00

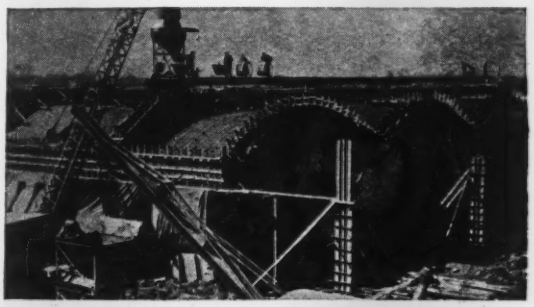
Schedule E

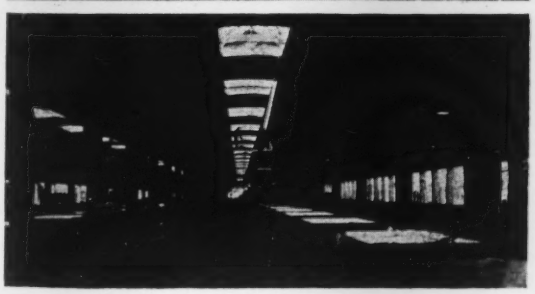
Item	Quan.	Unit Prices (1)	(2)	(3)
1. Tunnel timbering, exc. betw. sta. noted	80 M bm.	$100.00	$100.00	$100.00
2. Steel supports, except betw. stations noted	200 ton	110.00	110.00	110.00
3. Filling voids outside hvy. c. i. tun. lining	310 l. f.	125.00	205.00	79.00
4. Hollow terra cotta tile masonry	5 c. y.	70.00	100.00	45.00
5. Str. steel not otherwise provided for	1,380 ton	150.00	120.00	125.00
6. Misc. galvanized steel	300 lb.	.30	1.50	.36
7. Misc. steel, not incl. in Item 6	52,550 lb.	.25	.30	.26
8. Misc. malleable iron	720 lb.	.40	1.00	.65
9. Cast-iron castings	9 ton	400.00	500.00	400.00
10. Cast-steel castings	4 ton	500.00	600.00	500.00
11. Steel reinf. bars built in conc	590 ton	150.00	175.00	120.00
12. Wire mesh used in rein. conc. except as under Item 13	364,700 lb.	.12	.20	.13
13. Wire mesh for beam and column wrap	800 lb.	.50	.20	.19
14. Furn. and set steel curb with anchorages	15,350 l. f.	4.00	4.00	4.25
15. Permanent tie-rod units	90 ea.	150.00	200.00	190.00
16. Type A ceiling hanger units for hvy. cast iron tun. lining	30 ea.	40.00	50.00	48.00
17. Type D ceiling hanger units for Manh. constr. shaft	8 ea.	75.00	75.00	70.00
18. Erect hvy. c. i. tunnel lining (Auth.)	116 ring	600.00	600.00	550.00
19. 1-ply waterproofing, tr. woven fabric, lsid in coal tar pitch or asph	320 s. y.	1.00	1.00	.60
20. Waterproofing, brick laid in asph. mastic	35 c. y.	60.00	60.00	45.00
21. 4¼x4¼-in. ceramic tile, no grippers (Auth.)	164,800 s. f.	.50	.80	.48
22. 6x6-in. glass ceil. tile, with grippers (Auth.)	164,000 s. f.	.35	.70	.33
23. Glazed architect. terra cotta	43,800 s. f.	2.00	1.80	2.25
24. 6-in. c. i. b. and s. cem. lined pipe, fittings	7,340 l. f.	3.00	2.50	2.10
25. 6-in. c. i. flanged cem. lined pipe, fittings, valves and specials	350 l. f.	6.00	4.50	3.20
26. 1¼-in. wr. iron pipe ferrules	170 l. f.	3.00	1.00	.75
27. Galv. c. i. boxes, types CQ, CR, CS and CU, without covers; electr. install	17,900 lb.	.50	1.00	.40
28. As above, types CT, CV and CW	35,500 lb.	.50	1.15	.40
29. As above, types CL and CP	68,000 lb.	.50	1.30	.40
30. 1-in. silicon bronze elec. tubing, incl. br. boxes and fittings	1,500 l. f.	1.00	.50	1.50
31. 1¼-in., as above	3,600 l. f.	1.50	.80	1.75
32. 1½-in., as above	900 l. f.	2.00	1.00	2.00
33. 2-in. asbestos cement conduit	14,000 l. f.	.50	.80	.60
34. 2½-in. asbestos cement conduit	7,800 l. f.	.60	.80	.65
35. 3-in. asbestos cement conduit	31,000 l. f.	.70	.80	.70
36. 3½-in. galv. steel conduit, incl. fit	60 l. f.	3.00	2.00	2.00
37. 4½-in. galv. steel conduit, incl. fit	60 l. f.	3.00	2.50	2.50
38. 4¼-in. single-way vit. clay tun. ducts	37,440 duct. f.	.40	.40	.50
39. 3½-in. nine-way vit. clay tun. ducts	66,710 duct. f.	.35	.25	.30
40. 3¼-in. two-way vit. clay tun. ducts	7,500 duct. f.	.30	.30	.50
41. Reconstr. exist. bd. fence, Battery Pk	L. S.	10,000.00	7,000.00	7,500.00
42. Miscellaneous copper, in place	3,550 lb.	1.50	2.00	.75
43. Miscellaneous brass, in place	6,030 lb.	1.50	2.00	.75
44. Misc. bronze (exc. silicon br.)	120 lb.	1.50	3.00	.75
45. Silicon bronze bolts and nuts	60 lb.	1.50	3.00	1.50
46. Galv. c. i. boxes for air-meas. apparatus	520 lb.	1.50	2.00	1.00
47. Fresh air flues, types S, SW and OSW	1,384 ea.	60.00	70.00	60.00
48. Exhaust air ports for ceramic ceiling or same types for glass ceiling tile, types 6WA, 6WB and 6WC	308 ea.	75.00	75.00	100.00
49. As above for ceramic ceiling, types 6ND and 6NE, or for glass ceiling tile, 6ND, 6NE, 6NF and 6NG	494 ea.	75.00	75.00	95.00
50. As above for ceramic ceil., type 5NF, for glass ceil. tile, type 5NH	168 ea.	75.00	75.00	95.00
51. As above, for ceramic, type 4NG, for glass, type 4NJ	172 ea.	75.00	75.00	75.00
52. As above, for ceramic, 3NH; for glass type 3NK	228 ea.	75.00	75.00	65.00
53. Remove conc. and steel placed by others in Manh. constr. shaft and furn. and place fill	L. S.	5,000.00	10,000.00	25,000.00
54. Remove, relocate exist. field office bldg.	L. S.	25,000.00	40,000.00	50,000.00

MILE OF CONCRETE ARMY DEPOTS BUILT IN RECORD TIME



TOP-SPEED DEFENSE CONSTRUCTION WITH 'INCOR'





Concrete Warehouses, Columbus, O., General Depot, U. S. Army. Constructing Quartermaster: Lt. Col. A. F. Dershimer. Contractor: Corbetta Construction Co., New York. Designers: Roberts and Schaefer Co., Chicago-Washington.

FOUR firesafe warehouses, each 182′ wide and 1562′ long, with reinforced concrete frames carrying thin barrel-arched roofs, were completed in record time at U. S. Army's General Depot, Columbus, O.

Three of the warehouses (see air view, above) were built first. Using 'Incor' 24-Hour Cement and 6 sets of 80′ x 180′ forms, Corbetta Construction Company's progress schedule was based on pouring one 80′ section each work day, using each form set 10 times. First roof concrete placed March 2 . . . low temperatures through March, 8° to 46° . . . adequate protection supplied. Last pour, June 10. Based on strength tests of beams and cylinders cured under job conditions, concrete was stripped in 24 to 48 hours. *Twenty acres of warehouse structure concreted in record time!*

Forms were re-used on a nearby fourth warehouse. 'Incor' concrete was stripped throughout in 24 hours . . . this ¼-mile-long structure completed in 36 calendar days. Typical 'Incor' performance.

38,300 bbl. of 'Incor' were used in frame and roof construction of the four warehouses . . . 47,800 bbl. of Lone Star Cement in footings and other concrete. Speed defense . . . use 'Incor'* where dependable high early strength cuts form and heat-protection costs . . . elsewhere, use Lone Star. Better cement makes better concrete. Write for copy of "Cold-Weather Concreting." Lone Star Cement Corporation, Room 2281, 342 Madison Avenue, New York.

*Reg. U. S. Pat. Off.

LONE STAR CEMENT CORPORATION

Offices: ALBANY • BIRMINGHAM • BOSTON • CHICAGO • DALLAS • HOUSTON • INDIANAPOLIS • KANSAS CITY • NEW ORLEANS • NEW YORK • NORFOLK • PHILADELPHIA • ST. LOUIS • WASHINGTON, D. C.

MATERIALS AND LABOR PRICES

Market quotations on construction materials and wage rates reported monthly by ENR correspondents

NOVEMBER LUMBER prices continue to be the most active in the construction field. Mixed trends prevail, however, with higher prices reported in Baltimore, Dallas and San Francisco, and lower prices in New York. Short leaf Southern pine is $1.00 higher in Baltimore, and up $1.00 to $1.50 in Dallas, while New York reports a decrease of $1.00 to $2.00. Chicago prices are mixed, $1.00 lower on 1x6-in., but up $1.00 on 2x8-in. 3x12-in., both for pine and fir. Native pine is up $1.00 on some sizes in Denver. Douglas fir increases $1.00 to $1.50 in Baltimore, $2.50 on 2-in sizes in Kansas City, and $1.50 to $6.50 in San Francisco, but $2.50 to $3.00 lower in New York.

Portland cement is up 25c. per bbl. in St. Louis, and sand and gravel is higher in Los Angeles. Ready-mixed concrete is 25c. per cu. yd. higher in Boston, and up 50c. in Los Angeles. Paving asphalt rose in Cincinnati, Cleveland, San Francisco and Seattle. Reinforcing steel is up 10c. in Kansas City. Roofing supplies climbed in Cleveland, Kansas City, Minneapolis, New York, San Francisco and Seattle.

Skilled and common labor wages increased in Los Angeles. New rates are: bricklayers, structural ironworkers and hoisting engineers, $1.50 per hr.; carpenters, $1.175; plasterers, $1.667; and common labor, both on buildings and heavy construction, 75c.

CEMENT, AGGREGATES, READY-MIXED CONCRETE—F.O.B. CITY

	PORTLAND CEMENT (Per bbl., carload lots, including 40c per bbl. for bags, cash discount not deducted)			SAND AND GRAVEL (Per ton, carload lots)			CRUSHED STONE (Per ton, carload lots)		CRUSHED SLAG (Per ton, carload lots, f.o.b. plant)		CONCRETE Ready Mixed 1:2:4, 50 c.y. or more, delivered
	Cloth Bags *a*	Paper Bags	Bulk	Gravel, 1½ in.	Gravel, ¾ in.	Sand	1½ in.	¾ in.	1½ in.	¾ in.	
Atlanta	$2.95	$2.66	$2.61	$1.75	$1.85	$1.95	$1.75	$1.85	$1.55	$1.65	$7.90
Baltimore	2.36	2.11	1.91	1.75‡	1.75‡	1.25‡	1.75‡	1.75‡	1.75‡	1.75‡	7.00
Birmingham	2.50	2.25	2.05	1.75	1.75	1.40/1.50	1.00	1.00	.90	1.15	5.80
Boston	2.75*b*	2.50*b*	2.30	1.40‡	1.40‡	1.00‡	1.40‡	1.40‡	....	....	7.25*m*
Chicago	2.60	2.35	2.20	2.00‡*d*	2.00‡*d*	2.00‡*d*	2.00‡*d*	2.00‡*d*	1.50‡	1.50‡	....
Cincinnati	2.31	2.06	1.81	1.20	1.20	1.10	1.80	1.80	....	....	6.60
Cleveland	2.29	2.04	....	1.50*i*	1.50*i*	1.30*i*	1.90*i*	1.90*i*	1.70*i*	1.70*i*	7.30*i*
Dallas	2.47	2.22	2.02	1.75*p*	2.00*p*	1.25*p*	1.69*p*	1.84*p*	....	....	6.20
Denver	3.08	2.83	....	1.20	1.40	.90	....	....	....	....	7.25
Detroit	2.24	1.99	1.79	1.31	1.41	.91	1.50	1.50	1.65‡	1.65‡	6.50
Kansas City	2.56	2.31	2.16	1.85	2.30	1.00	1.91	1.91	....	....	7.25*n*
Los Angeles	2.25*b*	2.05*b*	....	1.20	1.20	1.15	1.20*j*	1.20*j*	....	....	6.35
Minneapolis	2.90	2.65	....	1.00*k*	1.00*k*	.25*k*	1.00*k*	1.00*k*	....	....	7.35*j*
Montreal	....	1.95*rs*	1.79*rs*	....	....	1.25‡*t*	.85‡*ct*	1.00‡*ct*	....	....	6.45*ls*
New Orleans	2.41	2.16	1.96	1.50	1.50	1.25	....	....	....	....	7.25
New York	2.55‡	2.30‡	....	1.50*de*	1.50*de*	.90*de*	1.65*de*	1.75*de*	....	....	6.75
Philadelphia	2.32	2.07	1.87	1.55‡	1.65‡	1.35‡	....	....	1.10	1.10	8.20*k*
Pittsburgh	2.44	2.19	1.99	1.40‡	1.40‡	1.70‡	2.25‡	2.25‡	1.50	1.50	8.25
St. Louis	2.80	2.52	....	1.50‡	1.50‡	1.25/1.50‡	1.10*h*	1.10*h*	.75*g*	.75*g*	7.75
San Francisco	2.16	1.96	1.66	1.36	1.36	1.36	1.46	1.46	....	....	6.95
Seattle	2.95*o*	2.70*o*	....	1.00*o*	1.00*o*	1.00*o*	2.00*o*	2.00*o*	....	....	7.25

‡ Delivered. *a* 10c. allowed for each returnable bag. *b* 10c. per bbl. off for cash. *c* Plus municipal tax. *d* Per cu. yd. *e* Barge lots alongside docks. *f* Crushed granite. *g* F.o.b. Granite City, Ill. *h* F.o.b. plant. *i* Within three miles of Public Square. *j* 5% discount for cash. *k* Discount 35c. 500 to 2000; 70c. 2000 to 5000; 95c. over 5000. *l* Up to 200cu. yd. *m* 50c. off for cash. *n* 25 c.y. or more. *o* 2% off for cash. *p* 10c. per ton off, cash 15 days. *r* 10c. per bbl. off, cash 20 days. *s* 8% sales tax included. *t* 8% sales tax not included.

CASH DISCOUNTS CEMENT to Contractors: truck delivery. 2% for cash on 10th of month; on carload deliveries, no trucking, same as dealer cash discount 10c. per bbl. for payment within 15 days of date of invoice. Subject discount 10c per bbl. 20 days in Montreal.

CURRENT MAXIMUM PRICES RECEIVED AT CEMENT MILL

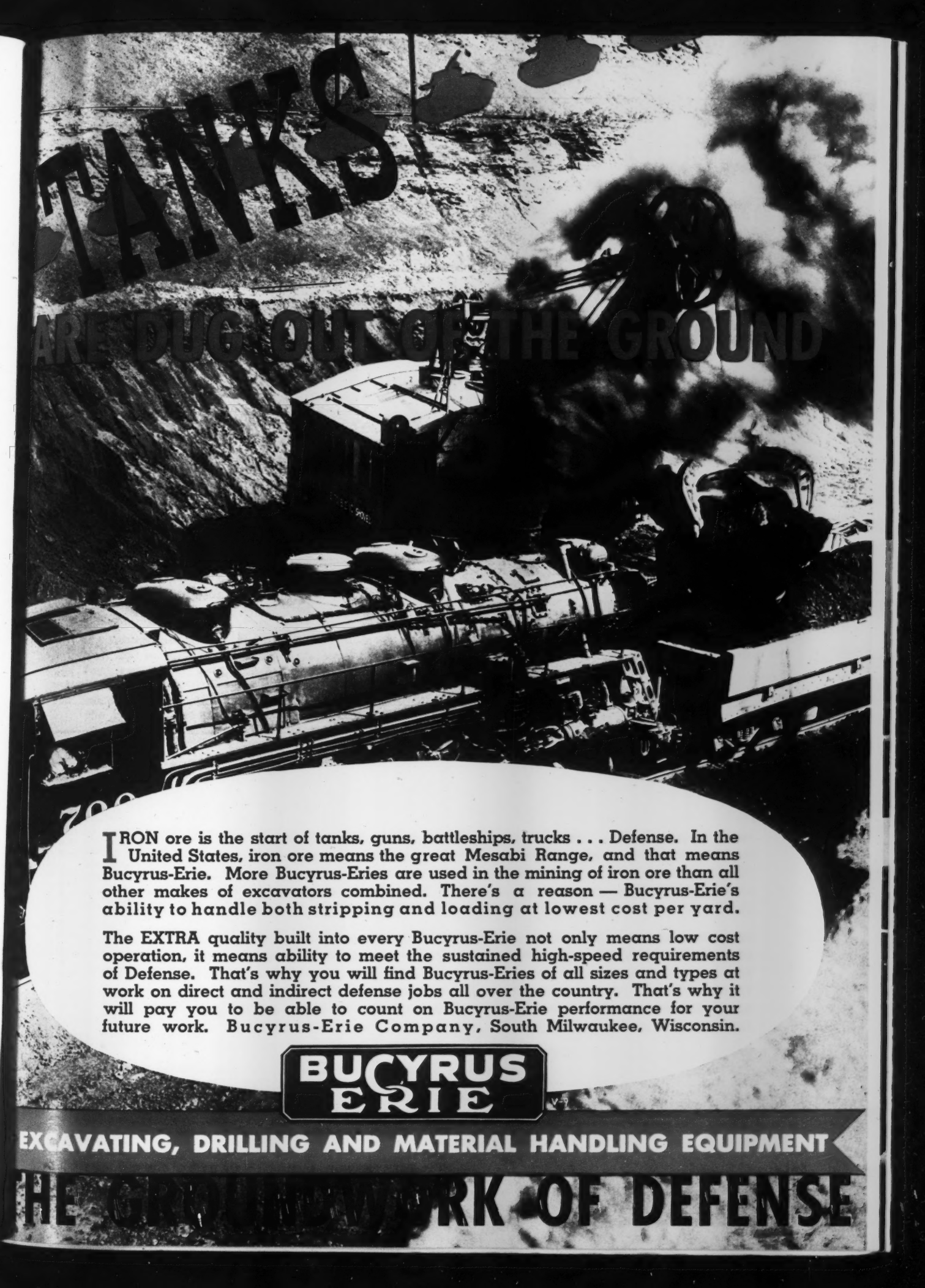
Charge for bags not included. For cloth bags, add 40c. per bbl.; 10c. refund allowed for each returnable bag; for paper bags add 15c. per bbl., not refundable.

	Bagged	Bulk		Bagged	Bulk		Bagged	Bulk
Buffington, Ind.	$1.70	$1.65	Ironton, Ohio	$1.60	$1.55	Richard City, Tenn.	$1.80	$1 75
Dallas, Tex. (Inc. 10c. tax)	1.85	1.80	Limedale, Ind.	1.70	1.65	Steelton, Minn.	1.80	1 75
Hannibal, Mo.	1.70	1.65	Norfolk, Va.	1.65	1.60	Universal, Pa.	1.65	1.60
Hudson, N. Y.	1.75	1.70	Northampton, Pa.	1.55	1.50	Waco, Tex (Plus 10c. tax in Tex.)	1.75	1.70
Independence, Kans.	1.70	1.65	North Birmingham, Ala.	1.70	1.65	Montreal (8% sales tax incl.)	1.68	1 67

PAVING BRICK, BLOCKS, ASPHALT, ROAD OILS—F.O.B. CITY

	PAVING BRICKS AND BLOCKS			PAVING ASPHALT (Per ton, less than 80 penetration)		ASPHALT BINDERS—FLUXES (Per gal., 80-300 penetration)		CUTBACK ASPHALT (Per ton)		ROAD OILS (Per gal.)	ASPHALT EMULSION (Quick-breaking) (Per gal.)	
	Granite per M. lots of 50,000 4x4x8 in.	Brick per M. 3×4×8½ in. carload lots	Wood per sq. yd. 3½ in. 16-lb. treat	Tank car	Drums	Tank car	Drums	Tank car	Drums	Tank car	Tank car	Drums
Atlanta	$73.00	$39.35	$2.25	$17.30*c*	$23.83*e*	$0.0695*e*	$0.1018*e*	$0.0734*he*	$0.1257*h*	$0.0634*e*	$0.0734	$0.1257
Baltimore	165.00‡	45.00‡	2.90	14.00	20.00	.06	.09	.065*h*	.115*h*	.....	.....	.....
Birmingham	.....	24.50*j*‡	....	18.20	23.20	.0747	.1047	.0834*h*	.1484*h*	.....	.....	.....
Boston	90.00	50.00	3.50	14.00	20.00	.06	.09	.065*h*	.115*h*	.065	.09‡	.12‡
Chicago	150.00	47.50	1.85*d*	14.50	18.50	13.00*g*	17.00*g*	.065*h*	.11*h*	.055	.095	.13
Cincinnati	112.00	37.50	....	16.00	20.00	.08	.....	16.80	.....	.07	.....	.085
Cleveland	110.00	39.00	2.25	20.00	25.50	.09	.11	.105*h*	11.00	.0675	.085	.095
Dallas	.....	36.00	....	13.25	20.30	.06	.103	16.00	24.80	.055	.05/.07	.07/.09
Denver	.....	27.50	....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Detroit	.....	35.00	....	14.10*f*	19.00*f*	.061	.1025	14.10	18.60	.0425	.0645	.098
Kansas City	.....	40.00	....	18.50	23.50	.077	.1075	.077*h*	.107*h*	.057	.11	.15
Los Angeles	.....	50.00	....	6.50*b*	15.00	6.50*bg*	15.00*bg*	5.50*b*	.....	.0192	.0525	.1125
Minneapolis	.....	.....	1.90*d*	21.20*m*	27.70	.10*m*	.126	19.00*m*	32.64	.06*m*	.....	.....
Montreal	75.00*k*	.....	3.62*k*	16.60*k*	24.25*k*	.116*k*	.1485*k*	.115*hk*	.135*hk*	.08*k*	.135*k*	.188*k*
New Orleans	.....	.....	....	14.00*a*	19.00*a*	.055	.085	.06*h*	.09*h*	.....	.078	.....
New York	.....	.....	2.90	15.00	21.00	.06	.09	.065*h*	.115*h*	.....	.....	.....
Philadelphia	120.00	42.50	2.84	15.00	22.00	.06	.12	.07*h*	.13*h*	.06	.07	.13
Pittsburgh	135.00	38.75	....	.....	.....	.....	.....	.....	.....	.....	.....	.....
St. Louis	115.00/125.00	37.00	....	14.00	18.00	12.00*g*	16.00*g*	.055*h*	.095*h*	.04	.09	.125
San Francisco	.....	70.00	....	9.50	18.00	9.50*g*	18.00*g*	10.00	17.50	.025	.0525	.1125
Seattle	.....	60.00*c*	....	16.70	26.10	.....	26.10*g*	12.50/13.50	26.00/27.00	10.75*g*	.0575*i*	.1308*i*

‡ Delivered. *a* F.o.b. Baton Rouge. *b* Delivered to purchaser's warehouse. *c* 3½x4x8½ in. *d* 2½ in. 6 to 8-lb. treatment. *e* Local reduction due to 20% reduction intra-state class freight rates, only Georgia affected. *f* Mexican *g* Per ton. *h* Per gallon. *i* F.o.b. Martinez. *j* 3x3⅝x8½ in. *k* tax included. *m* August prices; tank car price withdrawn in September.



IRON ore is the start of tanks, guns, battleships, trucks . . . Defense. In the United States, iron ore means the great Mesabi Range, and that means Bucyrus-Erie. More Bucyrus-Eries are used in the mining of iron ore than all other makes of excavators combined. There's a reason — Bucyrus-Erie's ability to handle both stripping and loading at lowest cost per yard.

The EXTRA quality built into every Bucyrus-Erie not only means low cost operation, it means ability to meet the sustained high-speed requirements of Defense. That's why you will find Bucyrus-Eries of all sizes and types at work on direct and indirect defense jobs all over the country. That's why it will pay you to be able to count on Bucyrus-Erie performance for your future work. Bucyrus-Erie Company, South Milwaukee, Wisconsin.

BUCYRUS ERIE

EXCAVATING, DRILLING AND MATERIAL HANDLING EQUIPMENT

THE [illegible] OF DEFENSE

IRON AND STEEL PRODUCTS — BASE MILL PRICES

	STRUCT. SHAPES-PLATE	REINF. BARS	RIVETS ½-in. structural	WIRE NAILS Base *d*	SHEET PILING Base	STEEL RAILS Per Gross Ton			TRACK SUPPLIES			
		½-in. billet *b*				Standard	Light	Re-rolled	Angle Bars	Std. Spikes *c*	Tie Plates *c*	Track Bolts
Birmingham	$2.10	$2.15	$3.75	$2.55	.....	$40.00	$40.00	$39.00	$2.70	$3.00	$2.15	4.75
Chicago	2.10	2.15	3.75	2.55	$2.40	40.00	40.00	39.00	2.70	3.00	2.15	4.75
Pittsburgh	2.10	2.15	3.75	2.55	2.40	40.00	40.00	39.00	2.70	3.00	2.15	4.75
Buffalo	2.10	2.15	.....	.....	2.40	.....	.....	.....	.....	.....	2.15	...
Cleveland	2.10	2.15	3.75	2.55	.....	.....	.....	.....	.....	.....	.....	...
Youngstown	.....	2.15	.....	.....	.....	.....	.....	.....	.....	3.00	.....	...
Detroit	.....	2.25‡	.....	.....	.....	.....	.....	.....	.....	.....	.....	...
Gulf ports	2.45*a*	2.50*a*	.....	.....	2.85*a*	.....	.....	.....	.....	.....	.....	...
Pacific ports	2.75*a*	2.80*a*	.....	.....	2.95*a*	.....	.....	.....	.....	.....	2.30	...

‡ Delivered. *a* F.o.b. cars dock. *b* Rail steel same as billet prices. *c* Other basing points include Portsmouth, O., Weirton, W. Va., St. Louis, Kansas City, Minnequa, Colo., and Pacific coast ports, on tie plates, alone, Steelton, Pa., on spikes alone, Lebanon, Pa., Richmond, Va. *d* Add switching charge $18 per c.l.

IRON AND STEEL PRODUCTS — F.O.B. WAREHOUSE, PER 100 LB., BASE PRICE

	STRUCTURAL SHAPES	REINFORCING BARS* Per 100 lb., ¾ in., base price			EXPANDED METAL LATH Per 100 sq.yd., carload lots		WELDED FABRIC REINFORCING Per 100 s.f., carload lots			SHEET PILING
	Per 100 lb. base price	15 tons or over *b* New billet	Rail steel	Add Switch	$/cwt. for Del.	Std. diamond mesh, 3.4 lb.	Std. ribbed 3.4 lb.	4x16 in., No. 5 & 10 wires	4x12 in., No. 8 & 12 wires	6 & 6 wires 6x6 in. No. Per sq. yd.	Per 100 lb. base price
Atlanta	$2.34	$2.39	$2.39	.02½	.10	$21.06	$23.00	$1.82	$1.35	$0.1719	$3.04
Baltimore	3.70	2.90	2.75	.....	.10	30.00	31.00	1.70	1.27	.1611	3.00
Birmingham	2.10*a*	2.15	2.15	.02½	.10	19.00	21.50	1.80	1.34	.1701	.....
Boston	3.75	3.11	3.01	$20 C.L.	.10	17.00	19.00	1.76	1.31	.1656	2.77
Chicago	2.10*a*	2.15	2.15	.03	.05	21.00	23.00	1.67	1.25	.1575	2.40
Cincinnati	3.68	2.51*cd*	2.51*cd*	.....	.05	19.50	21.50	1.66	1.25	.1566	.....
Cleveland	3.58*g*	2.15	2.15	.02½	.10	19.50	21.50	1.66	1.25	.1566	.....
Dallas	6.00	3.40	3.40	.....	.....	24.50	26.50	1.93	1.42	.1827	.....
Denver	4.35	3.95	3.80	.....	.....	26.50	28.50	1.97	1.45	.1863	.....
Detroit	3.65‡	2.25	2.15	.....	.10	22.00	24.00	1.68	1.26	.1584	2.66
Kansas City	4.17	2.61*cd*	2.61*cd*	.0	.05	19.50	23.50	1.78	1.33	.1683	2.86
Los Angeles	3.65*f*	2.25	2.10	.02½	.05	23.00	27.50	1.93	1.42	.1827	3.65
Minneapolis	3.80‡	2.48*c*	2.48*c*	.0	.10	25.00	27.00	1.80	1.34	.1701	2.73*d*
Montreal	3.90*i*	2.65*i*	2.55*i*	.....	.....	26.00*hi*	33.00*hi*	2.58*i*	3.22*i*	.264*i*	
New Orleans	4.40	2.52	2.52	.05	.10	21.50	23.50	1.82	1.35	.1719	2.875
New York	3.75	2.76*c*	2.76*c*	.....	.15	17.50	19.50	1.76	1.32	.1665	2.74
Philadelphia	3.75	2.66	2.56	.....	.....	19.50	21.50	1.71	1.28	.1611	2.72
Pittsburgh	2.10*a*	2.15	2.15	.02½	.10	23.00	26.50	1.59	1.20	.1503	2.40
St. Louis	3.69	2.39	2.39	.0	.05	26.00	29.00	1.69	1.27	.1602	2.70
San Francisco	4.70	2.65	2.50	.02½	.10	21.00	24.50	1.93	1.42	.1827	3.00
Seattle	2.75*e*	2.50*e*	.....	.....	.....	34.50	38.50	1.93	1.42	.1827	2.95*e*

‡ Delivered. *a* Mill prices. *b* 5–15 tons, add 15c. 1–5 tons, add 25c. Less than 1 ton, add 50c. *c* 20 tons or over Base. *d* Mill price plus freight. *e* F.o.b. dock. *f* Includes delivery in free delivery zone. *g* Less than 1 ton, add 25c.; 1 to 5 tons, add 10c. High scrap steel prices cut former 15c. differences between new billet and rail steel in many mills. *h* List price. *i* Plus Dominion and Province sales tax.

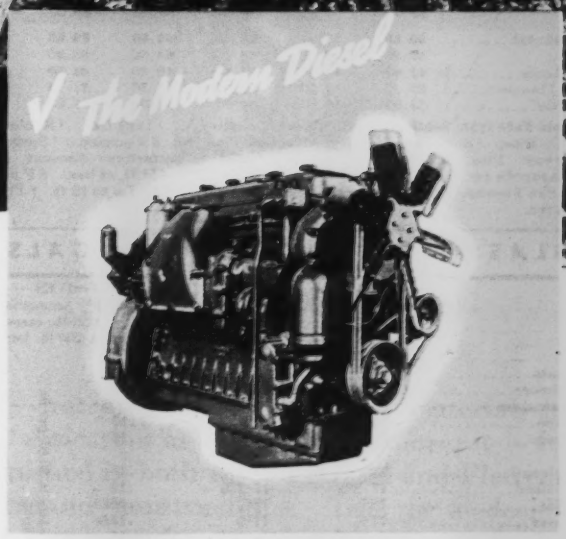
PLUMBING, HEATING, WATER, SEWER AND DRAIN PIPE

	C. I. PIPE	VITRIFIED SEWER PIPE				CLAY DRAIN TILE Per 1,000 ft., carload lots, f.o.b.		CONCRETE SEWER PIPE Per ft., delivered;		WROUGHT STEEL PIPE Full standard weight, *h*			
	Per net ton f.o.b. 6 in. to 24 in.*a*	Per foot, std. 8 in., e.s.	delivered std. 12 in., e.s.	ASTM 24 in.,	C13–35 36 in.,	6 in.	8 in.	ASTM 12 in.	C 14–35 24 in.	1 to 2 in., Butt Weld Black %	1 to 2 in., Butt Weld Galv. %	3½ to 6 in.; Lap Weld Black %	3½ to 6 in.; Lap Weld Galv. %
Atlanta	$49.40	$0.266	$0.4686*c*	$1.8525	$4.68*c*	$85.00	$128.00	$0.45	$1.642	62.2	54.2	59.7	51.2
Baltimore	52.80	.45	.70	2.50	6.90	120.00	160.00	.75	2.00	65.5	57.5	63.0	54.5
Birmingham	45.00	.275	.495	1.95	4.66	100.00	220.00	.40	1.60	62.2	54.2	59.7	51.2
Boston	55.00	.37	.70	....	....	210.00‡	325.00‡	.60	2.25	64.1	56.1	61.6	53.1
Chicago	53.80	.28	.54	2.25	6.25	100.00‡	150.00‡	.38	1.48	67.0	59.0	63.5	55.0
Cincinnati	52.70	.231	.4455	1.80	5.125	105.00	170.00	.60	1.70	65.9	57.9	63.4	54.9
Cleveland	54.24	.224	.432	1.80	5.125	81.60	125.00	.35	1.50	67.8	59.8	65.3	56.8
Dallas	58.20	.305	.549	2.25	5.00	90.00	110.00	.46	1.57	59.9	51.9	57.3	48.3
Denver	60.60	.24†	.52†	2.16†	.....	130.00	240.00	....	....	58.4	50.4	55.7	47.2
Detroit	54.24	.245	.4725	1.935	4.60	78.60	125.00	35	1.50	66.3	58.3	63.8	55.3
Kansas City	55.12	.315	.59	2.20	5.86	140.00	260.00	.45	1.60	62.9	54.9	60.0	51.5
Los Angeles	55.00	.282†	.508†	2.034†	5.085†	115.50	192.50	1.00	2.00	59.6	51.6	57.0	49.6
Minneapolis	59.00	.275†	.495†	1.98†	5.14†	.....	.....	.70	1.80	64.2	56.2	60.7	52.2
Montreal	60.00	.55	.90	3.68	5.95*e*	135.00‡	260.00‡	.48*l*	1.92*l*	.....	.....	.....	.....
New Orleans	51.38	.26	.48	1.69	.....	150.00	220.00	.37	2.10	62.4	54.4	58.8	50.3
New York	52.20	.455	.8775	2.925	7.65	.....	.....	.50	1.20	64.9	56.8	62.4	53.9*i*
Philadelphia	50.90	.....	.....	.....	.....	.....	.....	.54	1.80	65.3	57.3	62.8	54.3
Pittsburgh	55.60	.245†	.4725†	1.845†	5.4325	97.80	154.20	.85*g*	2.00*g*	68.5*i*	57.5*i*	66.0*i*	54.5
St. Louis	52.48	.28	.504	2.016	4.50	85.00	220.00	.90*j*	1.60*k*	65.1	57.1	62.0	53.5
San Francisco	55.00	.3625*d*	.6525*d*	2.61	6.52	115.50	192.50	.54	2.50	45.0	31.0	47.0	34.5
Seattle	55.35	.375	.675	2.70	6.75	84.00	187.50	.45*f*	1.40*f*	.....	.....	.....	.....

‡ Delivered. † F.o.b. *a* B. & S. class B and heavier, C/L lots, 200 tons and over Burlington, N.J. (base) $49.00. Gas pipe and class A, $3 per ton additional, 4 in., $3 per ton additional, 30 in. and larger usually $2 per ton less. *b* Double strength. *c* List to dealer. *d* List. *e* 30-inch. *f* Less 5% for cash. *g* Culvert pipe. *h* Discounts from standard list consumers carload prices, except Pittsburgh prices are f.o.b. mill. Base price $200 per net ton. List prices per ft.: ¾ in., 8½c.; 1 in., 11½c.; 1 in., 17c.; 2 in., 37c.; 2½ in., 58½c.; 3 in., 76½c.; 4 in., $1.09; 6 in., $1.92. *i* Applies also at Lorain, Ohio, mills. Chicago delivered base is 2½ points less on butt, 1½ on lap. Freight is figured from Pittsburgh, Lorain, O., Chicago Dist. Billing is from point producing lowest price at destination. WROUGHT IRON PIPE: Base price and list prices per ft. same as wrought steel pipe. Discount for Pittsburgh base: Butt-weld—1 in. and 1¼ in. black 34, galv. 16; 1¼ in. black 38, galv. 18½; 2 in. black 37½, galv. 18. Lapweld—2½ in. to 3½ in. black 31½, galv. 14½ in.; 4½ in. to 8 in. black, 32½ galv. 17. *j* Reinforced; spec. C 76-37. *k* Reinforced; spec. C 75-37. *l* Plus sales tax.

TO MAINTAIN *Today's* SCHEDULES .. TO MEET *Tomorrow's* COMPETITION

POWER YOUR JOB WITH 2-CYCLE DIESELS!



If you're squeezed for time to meet today's high-ball dirt moving schedules, the output-producing features of Allis-Chalmers 2-cycle Diesel tractors will give you the answer. If you're keeping an eye on the competitive field of the future, the reasonable first cost and lower operating and upkeep expense of these modern 2-cycle Diesels will impress you. Here's what you get:

1. MORE TIME FOR WORK . . . with instant electric starting and a 200-hour supply of lubricant for truck wheels and idlers. These output-builders get to work the minute the shift starts . . . no costly waiting for cranking, warm-up or greasing.

2. THE STEPPED-UP PERFORMANCE OF MODERN 2-CYCLE DIESEL POWER . . . In the chain of progress from steam to gasoline to Diesel, 2-cycle Diesel adds the latest link to lower dirtmoving costs. Because it delivers power every downstroke (twice the power strokes of a 4-cycle engine at the same speed) the modern 2-cycle Diesel gives you the smoothness, the "lugging" power and flashing throttle response of a good steam engine plus all the cost-cutting advantages of Diesel operation. On the job, the *extra performance* of 2-cycle Diesel power means top-notch production at minimum labor and fuel costs.

3. MAXIMUM POWER AT HIGH ALTITUDES . . . Because these modern 2-cycle Diesels do not depend on suction strokes for air intake but are "blower fed" under pressure, high altitude means little to their performance. Up 8,000 feet — when conventional 4-cycle engines lose 30% of their power — these 2-cycles still deliver 92% of their sea-level power!

Investigate these modern cost-cutters. Your Allis-Chalmers dealer will gladly show you just what they can do for you.

ALLIS-CHALMERS TRACTOR DIVISION—MILWAUKEE, U. S. A.

2-CYCLE DIESEL POWER

3 SIZES—HD-7, HD-10, HD-14. 60 TO 132 DRAWBAR H. P.

LUMBER, TIMBER, PLYWOOD — PER M FT., B.M., CARLOAD LOTS F.O.B.

	SHORT LEAF YELLOW PINE AND DOUGLAS FIR — All S. L. Y. P. is No. 2 common or better and for No. 1 N. C. Box. (Prices in Bold Face) *All Fir planks No. 2 common, Fir timber is No. 1 common. Lengths up to 20 ft. (Prices in italics)*									LONG LEAF Y. P. Merchantable grade up to 20 ft.		PLYWOOD[a] Rail freight increment (See note for base price)
	1x6 S4S	1x8 S4S	2x4 S4S	2x6 S4S	2x8 S4S	2x10 S4S	3x12 R2h	6x12 R2h	12x12 R2h	2x12 R2h	12x12 R2h	5/8"
Atlanta	**$27.00**	**$27.00**	**$26.00**	**$28.00**	**$28.50**	**$30.00**	**$43.00**	.....	.....	**$60.00**	**$65.00**	**$17.75**
Baltimore	**39.00**	**40.00**	**40.00**	**38.00**	**38.00**	**40.00**	**56.00**	.....	.....	89.00	94.00	17.35*g*
	44.00	*44.50*	*45.00*	*45.00*	*45.00*	*47.00*	*66.00*	*$59.00*	*$59.00*	.....	.....	.....
Birmingham	**34.50**	**34.50**	**32.00**	**32.00**	**32.00**	**34.00**	**53.00**	**51.00**	**53.00**	.....	.....	16.25
[1]	37.50	37.50	37.00	37.00	37.00	43.00	65.00	.....	.....	67.50	70.00	.....
Boston	38.00[2]	38.00[2]	45.00[2]	45.00	70.00[1]	75.00[1]	85.00[1]	.....	.....	85.00	90.00	17.35*g*
	40.00	*40.00*	*50.00*	*50.00*	*50.00*	*50.00*	*70.00*	*75.00*	*75.00*	.....	.....	.....
Chicago	**43.00**	**42.00**	**42.00**	**42.00**	**44.00**	**45.00**	**54.00**	.....	.....	90.00	100.00	13.80
	45.00	*44.00*	*44.00*	*44.00*	*46.00*	*47.00*	*50.00*	*50.00*	*50.00*	.....	.....	.....
Cincinnati	**40.00**	**41.50**	**38.00**	**39.50**	**40.00**	**41.00**	**52.50**	.....	.....	60.00	63.00	16.25
	.....	.....	.....	.....	.....	.....	*54.50*	*54.50*	*54.50*	.....	.....	.....
Cleveland	**42.00**	**42.00**	**42.00**	**42.00**	**44.00**	**47.00**	**55.00**	55.00	55.00	90.00	90.00	16.70
Dallas *e*	**39.00**	**40.00**	**39.00**	**37.50**	**38.00**	**39.50**	**53.00**	**53.00**	**53.00**	78.00	83.00	13.90
Denver ‡	54.00[4]	52.00[4]	55.00[4]	54.00[4]	54.00[4]	56.00[4]	59.00[4]	69.00[4]	75.00[4]	.....	.....	9.90
Detroit	**46.00**	**46.00**	**46.00**	**46.00**	**46.00**	**48.00**	**53.00**	.....	.....	53.00	61.50	16.25
	.....	.....	.....	.....	.....	*51.50*	*54.00*	*60.00*	*60.00*	.....	.....	.....
Kansas City	**42.50**	**45.00**	**42.50**	**42.50**	**45.00**	**47.50**	**55.00**	.....	.....	70.00	75.00	12.25
	50.00	*50.00*	*50.00*	*50.00*	*50.00*	*50.00*	*60.00*	*70.00*	*70.00*	.....	.....	.....
Los Angeles *a*	*52.00*	*52.00*	*50.00*	*50.00*	*52.00*	*52.00*	*56.00*	*65.00*	*56.00*	.....	.....	9.35*gh*
Minneapolis ‡*b*	48.00[3]	48.00[3]	.....	.....	.....	.....	.....	.....	.....	.....	.....	12.05
‡	*50.00*	*50.00*	*52.00*	*51.00*	*51.00*	*52.00*	*58.00*	*61.00*	*61.00*	.....	.....	.....
Montreal †[7]	*56.00*	*58.00*	*56.00*	*58.00*	*40.00*	46.00	.....	.....	.....	155.00	165.00	.....
	53.50	*53.50*	*54.25*	*54.25*	*59.25*	*59.25*	*65.00*	*65.00*	*65.00*	.....	.....	.....
New Orleans	**31.50**	**31.50**	**33.75**	**31.75**	**32.00**	**34.25**	**48.00**	.....	.....	58.50	69.00	13.90
	31.00	*31.00*	*33.00*	*31.00*	*31.00*	*32.00*	*33.00*	.....	.....	.....	.....	.....
New York ‡	**46.00**	**47.00**	**45.00**	**46.00**	**47.00**	**49.00**	**57.00**	.....	.....	100.00*f*	110.00*f*	17.35*g*
‡	.....	.....	*62.00*	*62.00*	*62.00*	*62.00*	*65.00*	*67.00*	*67.00*	.....	.....	.....
Philadelphia	**24.00**	**24.50**	**25.50**	**25.50**	**27.50**	**27.50**	**29.00**	.....	.....	50.00	57.50	17.35*g*
	35.00	*36.50*	*39.00*	*38.25*	*29.00*	*39.00*	*44.00*	*32.00*	*32.00*	.....	.....	.....
Pittsburgh	**50.80**	**53.20**	**62.75**	**55.00**	**60.85**	**62.50**	**76.25**	.....	.....	.....	.....	17.00
	69.20	*68.10*	*66.10*	*65.80*	*65.20*	*65.65*	*88.75*	*88.75*	*88.75*	.....	.....	.....
St. Louis ‡*c*	**42.00**	**42.00**	**42.50**	**40.50**	**41.50**	**43.00**	**56.00**	*67.00*	*67.00*	78.00	77.00	13.90
San Francisco *d*	*33.50*	*33.50*	*36.25*	*34.50*	*34.50*	*34.50*	*40.00*	*39.50*	*39.50*	.....	.....	7.30*g*
Seattle	*35.00*	*35.00*	*35.00*	*35.00*	*35.00*	*35.00*	*40.00*	*40.00*	*40.00*	.....	.....	0.00

Bold Face type, Southern Pine. *Italics, Douglas Fir.* [1] Long leaf. [2] Roofers' N. C. Pine. [3] Spruce. [4] Native. [5] Western Pine, No. 3 Common. [7] Spruce. [8] Norway Pine. ‡ Delivered. *a* Yard prices. *b* Contractors discount in Minneapolis and St. Paul discontinued May 21, 1938. *c* 5M ft. or less. *d* F.o.b. cars San Francisco freight rate. *e* 10% discount taken off. *f* Up to 18 ft. † Plus sales tax.

NOTE: Special concrete form grade Fir Plywood, 4' by 8' panels, 5-ply, sanded 2 sides, water resistant glue, carload lots, delivered per 1,000 sq. ft. surface. Seattle base price on 5/8", $86.50; on 3/4", $95.30; price includes oiling and sealing charges. For other centers add rail freight increment from table or proper size. For resin dipped treatment, add $10.50 per M. *Many mills out of market due to rush of defense orders. *g* Lower rate by water shipment. *h* 50,000 lb. minimum

GLASS, EXPLOSIVES, CHEMICALS

	WINDOW GLASS — Discounts from jobbers list, Aug. 15, 1938 Single or Double Thickness A quality	B quality	EXPLOSIVES — Per lb. 40% Ammonia Gelatin in 50-lb. cases delivered in 200 lb. lots*
Atlanta	75%	75%	$0.15
Baltimore	79%	80%	.15
Birmingham	75%	75%	.105
Boston	78%	79%	.15
Chicago	79%	79%	.15
Cincinnati	77%	77%	.15
Cleveland	77.2%	77.2%	.19
Dallas	78%	78%	.1625
Denver	77%	77%	.155*e*
Detroit	79–10%	79–10%	.15
Kansas City	77–10%	77–10%	.155
Los Angeles	86%*d*	88%*d*	.1575
Minneapolis	76%	76%	.155
Montreal	40–10%‡	50–5%‡	.155†
New Orleans	70%	75%	.16
New York	81%	82%	.22*f*
Philadelphia	82–10%*d*	83–10%*d*	.15
Pittsburgh	79%	79%	.1225
St. Louis	77–10%	77–10%	.155
San Francisco	78%	80%	.155
Seattle	75%	76%	.1575†

Price of 60% Ammonia Gelatin is $0.01 per lb. higher than 40%

a Disc. from list Sept. 1939. *b* Also less 6% tax exemption. *d* Discount from jobbers' list Sept. 15, 1928. ‡ Plus sales tax.

* Urban prices influenced by service charges or local storage and delivery regulations, do not consistently reflect quantity prices in less congested areas. *e* F.o.b. Louviers, Colo. *f* In boroughs of Kings, Queens and Richmond, and in Manhattan south of Canal Street, add delivery charge of $6.00 per trip. † F.o.b.

40% Ammonia Gelatin price ranges in other than urban areas, per lb. (except Seismograph Grades)

	C. L. 20,000 lb. net	Tons	200 lb. lots
E. of the Miss., except Fla. and Me.	$0.105	$0.13	$0.15
W. of Miss. to Rocky Mtn. States, Fla. and Maine	.11 –.1175	.135 –.1475	.155 –.1675
Rocky Mtn. States	.11 –.1225	.135 –.1525‡	.155 –.1725‡
Pacific N. W. States	.1075–.12	.1375–.15	.1575–.17
Pacific S. W. States	.1050–.1150	.135 –.145	.155 –.165

‡F.o.b. Louviers, Colo., or Butte, Mont.

PILES, TIES — F.O.B.

PILES

Prices per linear foot, pine, with bark on, f.o.b. New York; delivered from barge 1½ to 2c. per ft. additional:

Dimensions	Points	Length	Short Leaf — Barge	Short Leaf — Rail
12 in. at butt	6 in.	30 to 50 ft.	$0.22	$0.195
12 in.— 2 ft. from butt	6 in.	50 to 59 ft.	.26	.24
12 in.— 2 ft. from butt	6 in.	60 to 69 ft.	.28	.255
14 in.— 2 ft. from butt	6 in.	50 to 69 ft.	.30	.265
14 in.— 2 ft. from butt	6 in.	70 to 79 ft.	.36	.275
14 in.— 2 ft. from butt	5 in.	80 to 85 ft.	.42	.415
14 in.— 2 ft. from butt	5 in.	85 to 89 ft.	.45	.482

RAILWAY TIES

Prices f.o.b., per tie for carload lots:		6"x8"x8' Untr.	6"x8"x8' Tr.	7"x9"x8'6" Untr.	7"x9"x8'6" Tr.
Boston	Oak	$1.30	....	$1.80	....
	Pine	1.60	$2.40*a*	2.40	$3.40*a*
New York	S. L. Sap Pine	1.30/1.40	2.05	1.60	2.55
	Mixed Oak	1.55	2.05	2.00	2.65
Birmingham	White Oak	.85	1.50*a*	1.35	1.70*a*
	Southern Pine	.55*b*	1.10*ab*	.70	1.30*a*
Chicago	Oak	....	1.65*a*	....	2.25*a*
	Southern Pine	....	1.53*a*	....	2.13*a*
Los Angeles	Douglas Fir	1.10	1.75*a*	1.60	2.50*a*
Philadelphia	Red Oak	1.10	....	....	2.40*a*
St. Louis*	White Oak	1.40	....	1.75	....
	Red Oak	1.40	1.85*a*	1.75	2.35*a*
	Sap Pine or Cypress	1.30	....	1.65	....
San Francisco	Douglas Fir	1.00*bef*	....	....	2.45*af*
Montreal	Birch or Maple	.65	1.05*a*	.75	1.35*a*

Tr.— Treated; Untr.— Untreated. *a* Creosoted. *b* 6" x 8" x 8'6". *e* Empty cell. *d* Zinc. *e* Green. *f* At ships tackle. *August prices; none later quoted.

CHEMICALS

Water, sewage treatment, road work, f.o.b. carlots, New York

Bleaching powder, in drums, f.o.b. works, per 100-lb	$2.00–2.85
Chlorine cylinders, liquid, per lb. delivered	.0525
Calcium chloride, 77–80%, flaked, in 400-lb. drums or 100-lb. moisture proof bags, delivered, per ton	20.50–35.00
Silicate of soda, 52 deg., in drums, f.o.b. works, per 100 lb	1.40
Soda ash, 58%, in paper bags, per 100 lb. dense	1.15
Sulphate of aluminum, commercial, in 100-lb. bags, per ton	23.00–25.00
Sulphate of copper, in bbl., per 100-lb	5.00–5.50

Time and Materials Are VITAL Factors In Defense... Both Can Be SAVED By the Use of.....

THERE are definite reasons why both time and materials can be saved by the use of Preformed "HERCULES" (Red-Strand) Wire Rope. These reasons are the result of the Preforming process *plus* the inherent quality and correct manufacturing methods used in making this world known brand of wire rope.

(1)

On account of its easier handling and smoother spooling it can be installed more quickly.

(2)

As it lasts so much longer, less time is spent in making replacements.

(3)

Because it does last longer, the same amount of steel used in making this rope will do more work, thereby making an actual saving in material.

When you buy Preformed "HERCULES" (Red-Strand) Wire Rope, you get a Preformed wire rope of the very highest quality —not only as to quality of material, but fabrication as well. Furthermore, it is furnished in both Round Strand and Flattened Strand constructions. This is a decided advantage, for now in this one grade you can secure a correct type of rope for every heavy duty purpose.

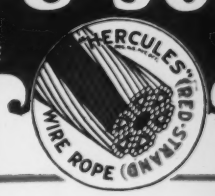
And the same principles that enable Preformed "HERCULES" to save time and material, also make for greater economy. Why not take advantage of this three-way saving?

MADE ONLY BY

A. LESCHEN & SONS ROPE CO.

WIRE ROPE MAKERS — ESTABLISHED 1857

5909 KENNERLY AVENUE — ST. LOUIS, MISSOURI, U. S. A.



NEW YORK . . . 90 West Street
CHICAGO . . 810 W. Washington Blvd.
DENVER . . . 1554 Wazee Street

SAN FRANCISCO . . 520 Fourth Street
PORTLAND . . 914 N. W. 14th Avenue
SEATTLE . . 3410 First Avenue South

STRUCTURAL CLAY BUILDING TILE, BRICK AND LIME—DELIVERED

	STRUCTURAL CLAY TILE — PARTITION — SCORED Per M. lots of 2,000 pieces or over, 3x12x12 in.	4x12x12 in.	8x12x12 in.	STRUCTURAL CLAY TILE — LOAD BEARING — SCORED Per M. lots of 2,000 pieces or over, 8x12x12 in.	10x12x12 in.	12x12x12 in.	BRICK Per M. in quantity, Common backing	Straight hard	LIME Per ton, Hydrated finishing	In paper, Common hydrated	Carload lots Pressured drums
Atlanta	$100.00	$110.00	$195.00	$230.00	$240.00	$240.00	$13.00	$18.00	$26.50	$17.00	$17.00
Baltimore	85.00	90.00	165.00	195.00	245.00	295.00	14.00*k*	17.00*k*	19.00	17.00	15.75*m*
Birmingham	80.00	85.00	160.00	191.00	252.00	288.00	14.50	17.00	18.11	13.64	12.50*p*
Boston	118.25*a*	126.40*a*	235.50*a*	.....	.....	.....	18.00*i*	21.00*i*	19.00	14.00	12.95*p*
Chicago	68.10	72.60	135.90	185.70	234.90	268.10	11.50	12.50	16.40	14.40	12.20
Cincinnati	65.55	69.90	131.20	148.70	210.35	240.45	17.50	17.50	15.40	12.90	.....
Cleveland	56.50	60.00	112.50	135.00	182.00	209.00	16.00	16.00	15.75*j*	14.50*j*	14.00*jm*
Dallas	52.00	54.00	100.00	135.00	200.00	263.00	11.50*i*	13.50*i*	19.00	15.00	12.95*p*
Denver	84.80	94.40	152.70	178.20	212.00	227.90	13.50	17.00	30.00*j*	19.00*j*	20.00*jq*
Detroit	69.00	73.60	138.00	176.00	232.00	265.00*e*	16.50	17.00	16.50	13.90	14.90
Kansas City	64.50	66.50	86.00*c*	125.50	159.75	186.25	15.50	24.00	19.10	12.80	10.70
Los Angeles	73.50†*r*	89.50†*r*	128.00*c*†*r*	210.00†*r*	368.00†*r*	460.00†*r*	13.50	15.00	16.50	17.50	17.50
Minneapolis	80.35	85.70	168.45	192.85	176.20	245.20	13.10	15.10*g*	21.00	16.00	19.00
Montreal	72.20*au*	77.50*au*	142.50*au*	76.00*atu*	165.80*au*	248.70*u*	17.50†*u*	24.25†*u*	23.20*u*	17.00*u*	12.00*u*
New Orleans	72.00	72.00	135.00	162.00	210.00	260.00	14.00	.....	18.30	12.08	14.10
New York	78.40	83.60	115.00*c*	193.30*h*	238.80*h*	295.60*h*	13.00	.....	19.00	14.00	17.00
Philadelphia	80.50	85.90	161.10	193.30	238.80	295.60	17.00*s*	19.00*s*	15.70*q*	10.55*q*	13.05*q*
Pittsburgh	62.35	66.55	124.75	140.25	173.25	198.00	17.50	19.50	17.90	15.40	12.55*m*
St. Louis	64.00	90.00	125.00	180.00	195.00	225.00	17.00	18.00	24.00	18.00	12.50*m*
San Francisco	84.00	94.50	225.00	.....	.....	.....	19.00	17.00	.75*o*	2.05*o*	16.40
Seattle	100.00	110.00	220.00	.....	.....	.....	17.50*f*	22.00*f*	20.00*s*	20.00*s*	20.00*s*

† F.o.b. *a* Smooth. *b* Carload lots delivered to job. *c* 6x12x12 in. *d* Not load bearing. *e* 48 lb. tile. *f* Less $1.00, ½ cash 15 days, balance 30 days. *g* Selected common. *h* F.o.b. Perth Amboy, N. J. *i* 50c. per M. off for cash. *j* LCL. *k* $1.00 discount if paid in 10 days. *l* Lump. *m* Per bbl., 180 lb *n* Per sack 100 lb. *o* Per bbl., 200 lb. *p* 280 lb. bag. *q* 25-ton cars. *r* 5% discount 10 days. *s* 2% off cash. *t* 5½ x 8 x 12. *u* Plus 8% sales tax.

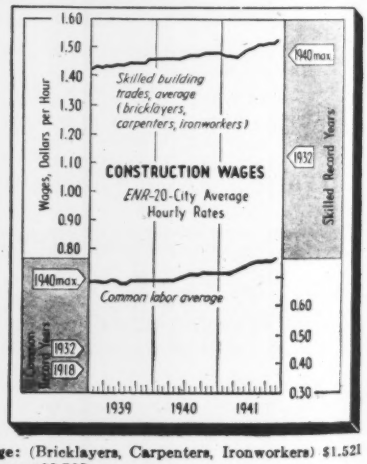
PAINT, ROOFING—F.O.B. CARLOAD LOTS

	RED LEAD Per 100 lb. in 600-lb. (Approx.) bbl. Dry *a*	WHITE LEAD Per 100 lb. in oil	READY-MIXED PAINT Per gal., drums Graphite *b*	Aluminum *c*	Ferric Oxide *d*	ROOFING SUPPLIES Carload lots f.o.b. factory Rolls, slate surfaced, 85-90 lb. per sq.	Asphalt felt, per 100 lb.	Tar felt, per 100 lb.	Asphalt coating per gal.	Tar pitch 350 lb. bbl. per ton
Atlanta	$9.50	$13.625	$1.30	$2.25	$1.20	$1.90	$1.61	$1.61	$0.27	$29.00
Baltimore	9.25	13.25	1.95	2.90	2.50	2.80	3.50	3.50	.80	2.75*m*
Birmingham	9.50	13.625	2.35	3.50	1.85	2.15	1.58	1.58	.32	27.00
Boston	9.25	13.25	2.25‡	2.70‡	2.00‡	2.02‡	1.85*h*‡	1.85*h*‡	.50‡	20.00‡
Chicago	9.25	13.25	2.11	2.63	1.72	1.48*hf*	1.50*hf*	1.50*hf*	.26*f*	22.00*f*
Cincinnati	9.25	13.25	1.70	2.90	1.60	2.40	2.39*h*	2.39*h*	.36	21.00
Cleveland	9.25	13.25	2.50	3.10	1.90	1.93	1.83*h*	1.83*h*	.40	25.00
Dallas	9.25	14.00	1.88	2.11*n*	....	2.50*h*	2.60*h*	2.70*h*	.50	34.00
Denver	9.75	13.75	1.65	2.60	.27*l*	2.45	3.15	3.15	.35	28.00
Detroit	9.25	13.25	1.75	3.00	1.45	2.40	2.50	2.50	.35	26.00
Kansas City	9.25	13.275	2.39*g*	2.55*g*	2.16*gn*	2.10	2.30	2.30	.28	27.50
Los Angeles	9.50	13.75	1.60	2.25	2.30	2.10	1.50	....	.45	.....
Minneapolis	9.25	13.375	....	....	....	1.93*i*	1.75*hi*	1.75*hi*	.29	22.00
Montreal *p*	9.25	9.00	2.40	2.97	2.51	2.64	1.85	1.86	.63	1.85*k*
New York	9.25	13.25	2.03	2.55	1.64	2.01	1.83*h*	1.83*h*	.23	25.00
Philadelphia	9.25	13.25	....	....	....	2.27*e*	1.94*he*	1.94*he*	.41*e*	22.00
Pittsburgh	9.25	13.25	1.05	1.95	.80	1.95	1.94*h*	1.94*h*	.34	26.00
St. Louis	9.25	13.25	1.90/2.00	2.60/2.80	1.60/2.00	1.92	1.91	1.91	.32	23.00
San Francisco	9.50	13.50	1.80	2.75*n*	1.10/2.00	1.89	2.66	2.66	.33	19.50
Seattle	9.50	13.75	1.80	2.60	....	2.12	1.45*h*	1.75	.35	24.15*j*

‡ Delivered. Note: Red lead in oil 50c. higher than white lead in oil. *a* Red lead prices change frequently due to pig lead price changes. *b* U. S. War Dept. Spec. 3-49A. *c* ASTM Spec. D266-31. *d* 80% minimum ferric oxide. *e* Subject to 25% discount. *f* Distributors' price to contractors. *g* 5 gal. can *h* Per roll, 65 lb. *i* Minneapolis and vicinity. *j* Asphalt pitch. *k* Per 100 lb *l* Per lb. *m* Per bbl. *n* May price, no later quotation available. *p* Plus 8% sales tax.

SKILLED AND COMMON WAGE RATES—PER HOUR

	Bricklayers	Carpenters	Struct. Iron Workers	Hoisting Engineers	Plasterers	Common Labor Building	Common Labor Heavy Const.
Atlanta	$1.375	$1.00	$1.375	$1.00/1.25	$1.25	$0.40	$0.50
Baltimore	1.625	1.375	1.65	1.65	1.50	.70	.70
Birmingham	1.50	1.125	1.50	1.50	1.50	.60	.45
Boston	1.50	1.25	1.50	1.625	1.625	.85	.85
Chicago	1.70	1.625	1.70	1.70	1.70	1.025	1.025
Cincinnati	1.625	1.50	1.55	1.325/1.525	1.625	.75	.75
Cleveland	1.75	1.50	1.75	1.75	1.75	1.00	1.00
Dallas	1.50	1.00	1.25	1.00	1.50	.50/.625	.50/.625
Denver	1.65*b*	1.43*b*	1.43*b*	1.43*b*	1.50*b*	.718*b*	.718*b*
Detroit	1.60	1.40	1.75	1.625	1.675	.80	.80
Kansas City	1.625	1.375	1.50	1.50	1.575	.85	.50
Los Angeles	1.50	1.175	1.50	1.50	1.667	.75	.75
Minneapolis	1.50	1.25	1.50	1.40	1.50*e*	.90	.90
New Orleans	1.50	1.25	1.50	1.375	1.375	.55	.55
New York	2.00*b*	1.85*b*	2.00	2.00*b*	2.00*c*	1.031	.95
Philadelphia	1.65*b*	1.40	1.65	1.50	1.75	.70	.70
Pittsburgh	1.90	1.50	1.75	1.25	1.75	.80	.70
St. Louis	1.25/1.50	1.50	1.75	1.50/2.00	1.25/1.75	.675/.875	.875
San Francisco	1.75*c*	1.375	1.60	1.50	1.667*c*	.85/.875	.85/.875
Seattle	1.65	1.35	1.55	1.50	1.65	.95	1.00
Montreal	.92	.81	.87	.76	.90	.53	.46

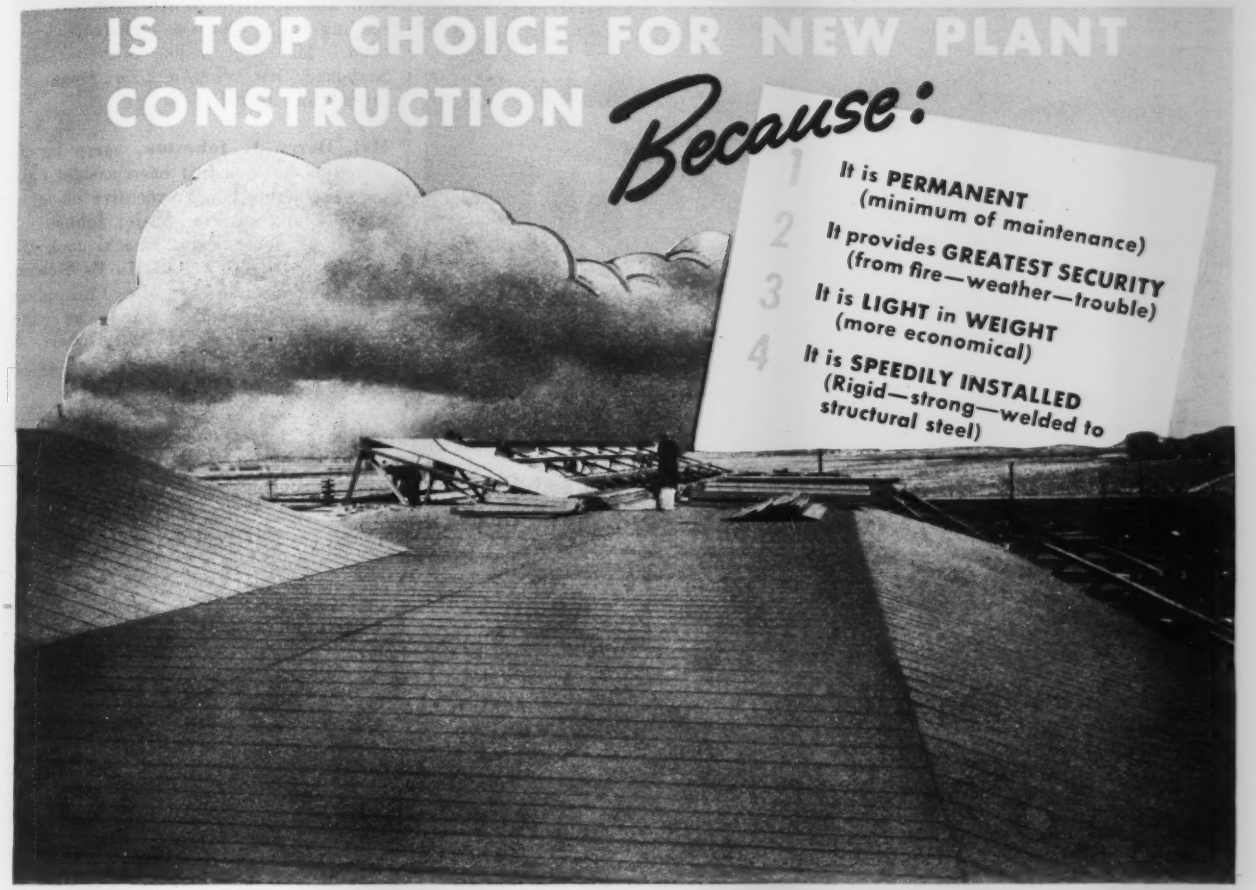


b 7 hr. day. *c* 6 hr. day. *d* 35 hr. wk. *e* 30 hr. wk.

ENR Skilled Average: (Bricklayers, Carpenters, Ironworkers) $1.521
ENR Common Average: $0.768

MAHON STEEL ROOF DECK

IS TOP CHOICE FOR NEW PLANT CONSTRUCTION *Because:*


1 It is PERMANENT (minimum of maintenance)
2 It provides GREATEST SECURITY (from fire—weather—trouble)
3 It is LIGHT in WEIGHT (more economical)
4 It is SPEEDILY INSTALLED (Rigid—strong—welded to structural steel)

In the vast building program with which American industry is confronted, no factor is of greater importance than the ROOF of any building.

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Permanence—because it is rolled from special, copper-bearing steel, both 18 and 20 gauge, to insure long life. *Security*—because it is manufactured entirely of steel, providing the greatest possible protection from fire, weather and trouble. *Economy*—because its extremely light weight permits an appreciable saving throughout the entire structure. *Speed of Installation*—because it is an assembly of standard steel plates, quickly and easily fitted together and welded into an integral whole with the steel structure which supports it, insuring utmost strength and rigidity.

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One of the marvels of this modern age is our hundreds of thousands of miles of national highways. They are not only essential to our commercial, industrial and cultural development, but are indispensable to national defense. More important today than ever, the building of roads goes on continuously. In this important factor in our national welfare, GOHI Corrugated Pipe plays its part, by providing long-lived, low-cost drainage structures in a hurry! Installation is quick, easy, permanent.

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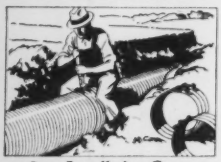
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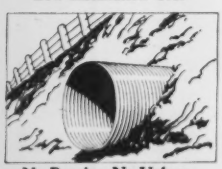
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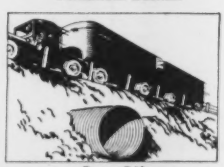
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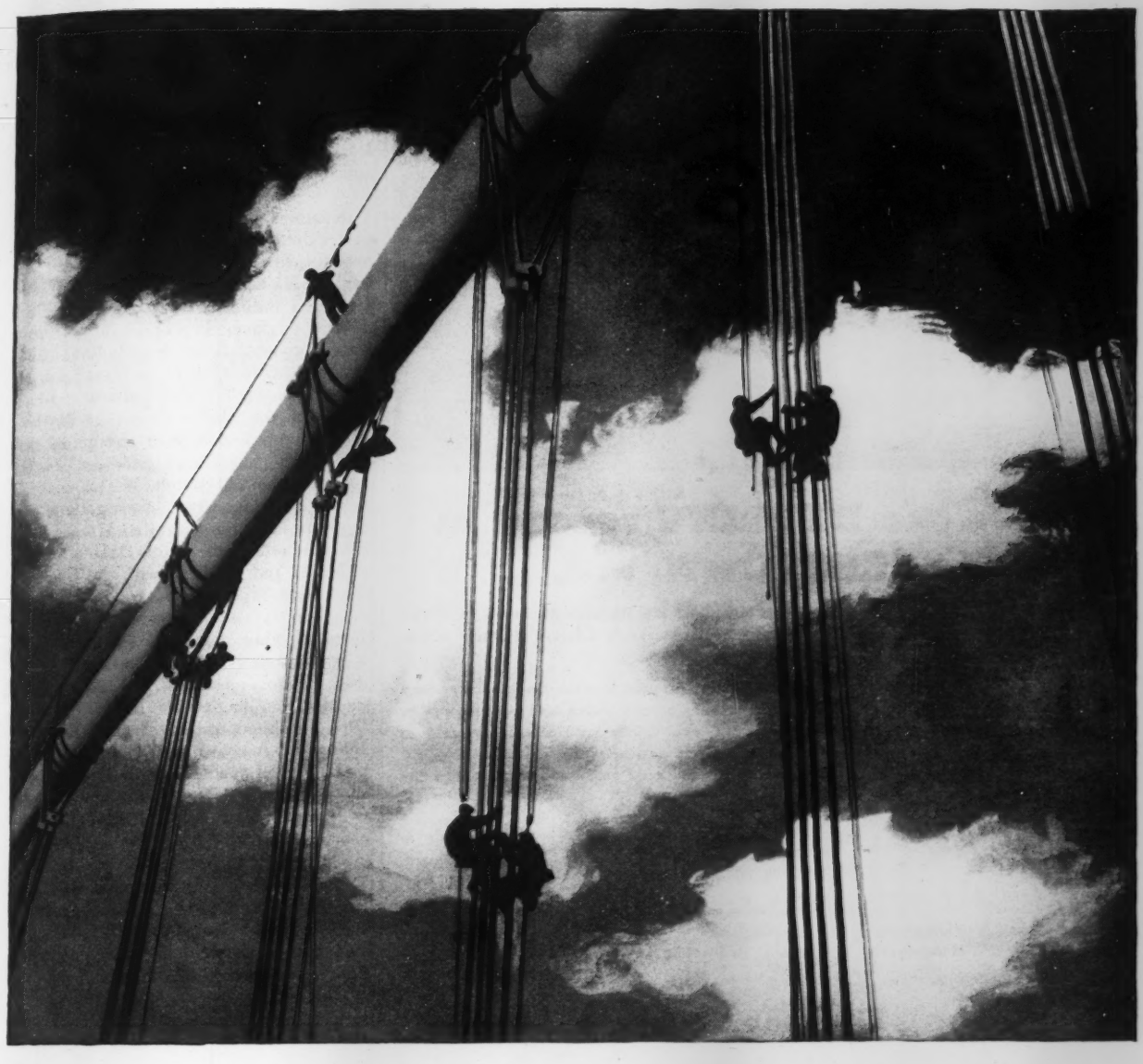
MEN AND JOBS

L. N. Riggan, a native of Wake Forest, N. C., and a graduate of the North Carolina State College, school of engineering, has just been appointed engineer of construction for the Seaboard Ry., with headquarters at Norfolk, Va., succeeding **H. S. Thomas,** who recently retired. Mr. Riggan has been with the Seaboard Ry. continuously since his graduation in 1912.

Maj. Harry A. Johnston, camp intelligence officer, has just been assigned the office of acting camp executive officer at Camp Blanding, Fla. Major Johnston, a native of West Palm Beach, took the post vacated by **Lt. Col. L. P. Stewart,** who leaves soon for the Philippines. Maj. Johnston will continue as camp intelligence officer. **Capt. Robert R. Conner,** Corps of Engineers, will act as assistant camp executive officer as well as continuing his present post of camp engineer. Captain Conner is a native of Vicksburg, Miss.

The Fourth Army Corps in Jacksonville, Fla. reports several promotions and personnel changes: **Col. Creswell Garlington,** Corps of Engineers, has gone to the Office of the Chief of Engineers in Washington. **Lt. Col. Wm. S. Heavy,** former commander of the 20th Engineers, Fort Benning, Ga., has been placed on temporary duty to replace Col. Garlington. **Lt. Col. Calvert Arnold** goes to Memphis, Tenn. to head the signal division of the Second Army and will be replaced by **Lt. Col. John A. Ballard. Maj. Garrison L. Beachy** has been made assistant in the Intelligence Section. Col. Heavy, a graduate of West Point and a native of Georgia attended the Command and General Staff School at Fort Leavenworth. Col. Ballard, a native of New York State, and a graduate of St. Lawrence University, also attended the Command and General Staff School. Major Beachy, a graduate of Mount Union College and the General Staff School, was a National Guard Officer of the 37th Division. He served in the Intelligence Section of the Third Army during the Louisiana maneuvers.

Medford T. Thomson, who has been principal assistant to the district engineer in the Boston (Mass.) District of the U. S. Geological Survey since July, 1938, was transferred to the Atlanta (Ga.) District to serve there as district engineer in charge of surface-water investigations in Georgia, effective September 5, 1941. Mr. Thomson graduated from Cornell University in 1925. He entered the employ of the U.S.G.S. in 1926. He succeeds **Francis M. Bell,** former



Why does a Bridge wear Red Suspenders?

THESE SUSPENDERS hold up something mighty important to Uncle Sam these days. Something that bridges gaps in a Nation's time . . . brings its far-flung coasts closer together . . . gives wings to its trains and its trucks.

But why *red* suspenders? Because they must not fail.

No better rust preventive exists than the Dutch Boy Red Lead with which this bridge was painted. It possesses a remarkable ability to protect bridges, ships, railroad equipment, tanks, pipe lines and other metal structures against corrosion. This superiority is due to the fact that in Dutch Boy the inherent protective qualities of pure red lead have been brought to a new peak of effectiveness as a result of intensive research by National Lead—both in the laboratory and on the job.

Available in three forms—paste, liquid, and a quick-drying type—Dutch Boy is made with highly oxidized red lead having a true red lead (Pb_3O_4) content of more than 97% and characterized by extremely fine particle size. This assures a smooth, durable protective film—that hugs tight and is highly resistant to weather, smoke, dampness, sulphurous gases, salt water and other causes of corrosion.

The quick-drying type, known as Dutch Boy Quick-Drying Red Lead, dries for recoating in two to six hours and was especially developed to take care of situations where allowable drying time is short.

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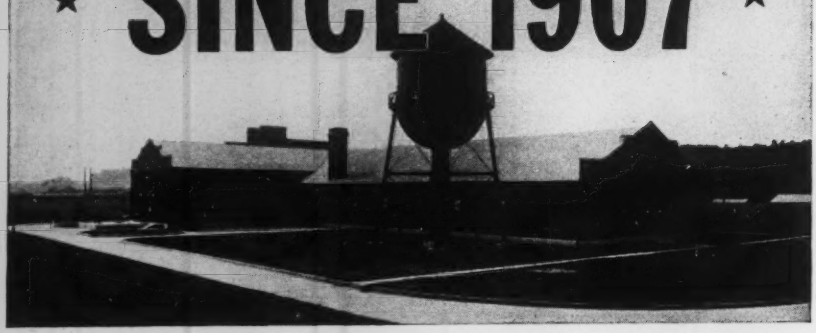

That's the DARLING record in HAGERSTOWN, Md.

For 54 years, Mr. Albert Heard has been an official of the Hagerstown Board of Water Commissioners. His recent letter makes a short, sweet story—of interest to every waterworks man in the country.

"I have used Darling Fire Hydrants, Gate Valves, and Tapping Sleeves continuously since 1907. Absolutely no valve repairs needed; . . . only normal valve and seat repairs to hydrants. Operation is faultless and positive. 24" gate valves on 6-mile force main at 125 lbs. working pressure have never failed to operate satisfactorily and close tightly." Again we say, Darling users are best salesmen. Take their word—specify Darlings for your next installation.

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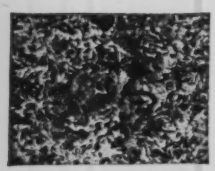
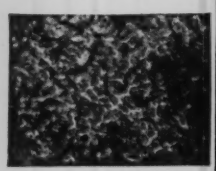
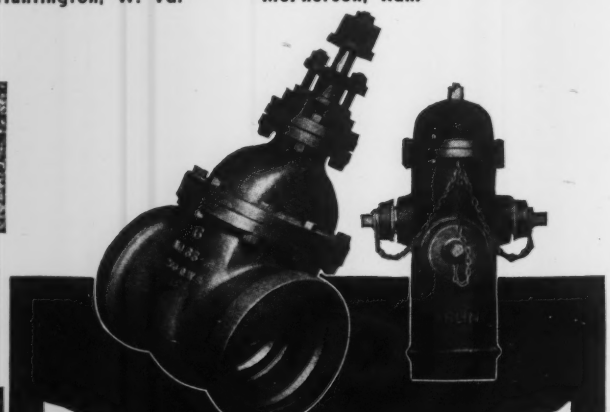


Photomicrograph (mag. 100x) showing the structure of a typical sample of cast iron as ordinarily produced. Note the entrained inclusions tending to break down the strength of the metal and produce leaks.



Showing the structure of Darling Dense Metal gray iron. In this dense, fine, homogeneous grain structure the shrinkage porosity has been minimized, with resultant pressure tightness, strength and better resistance to abrasion and corrosion.



DARLING
DENSE-METAL
GATE VALVES and HYDRANTS

district engineer at Atlanta, who has been transferred to the Chattanooga (Tenn.) District to serve there in the same capacity—district engineer in charge of surface-water investigations for Tennessee. Mr. Bell graduated from the University of North Carolina in 1925, and has been with the Survey since 1928.

Two other personnel changes are reported by the U.S.G.S. **Don M. Corbett,** former principal assistant to the district engineer at Chattanooga, has been transferred to Indianapolis to serve there as district engineer in charge of surface-water investigations for Indiana and Michigan. Mr. Corbett is a graduate of Utah State Agricultural College and has been with the Survey since 1924. **Harlan M. Erskine,** formerly in charge of the Pittsburgh sub-office, has been transferred to the Charleston, W. Va. district to make surface-water investigations for the State of West Virginia. Mr. Erskine is a graduate of the South Dakota School of Mines and has been with the Geological Survey for 10 years.

The following engineers and draftsmen were employed at Milwaukee for jobs in the Panama Canal Zone: **Lawrence Paetsch,** as engineering aide; **Marvin Diel,** architectural draftsman; **Victor Johnson,** structural design engineer; **F. D. McGuire,** engineer in masonry design; and **Clarence Neumann, George O. Charles,** and **H. G. Miller,** as engineering aides.

The Army ordnance plant and depot at Ravenna, Ohio, report personnel changes as follows: **Lt. Col. Raphael S. Chavin,** commanding officer of the Ravenna plant, has been ordered to command of the Illinois ordnance plant at Marion, Ill. Col. Chavin, whose home is in Washington, also had an additional duty as constructing quartermaster at the two Ravenna plants; in this capacity he is being succeeded by **Capt. Robert W. Lockridge,** of Lewiston, Pa., his former assistant. **Capt. Claron W. Meldrum** succeeds Col. Chavin as commanding officer at Ravenna. **Capt. W. H. Kremer,** of the arsenal staff at Ravenna, has been transferred to the Plum Brook ordnance plant at Sandusky, Ohio, and **Major Andrew Fabens** has gone to a new post at the Kingsbury plant at Laporte. **Lt. Col. John O'Connor,** of the construction department, has been transferred to the Charlestown, Ind., ordnance plant.

E. J. Allison has been appointed to the joint post of city manager and city engineer of Hays, Kansas. Formerly Mr. Allison was general superintendent of the Marshall Creek Dam in Wyandotte County, Kan. He is a graduate of the University of Kansas in civil engineering, and has held various engineering

and management jobs for the Work Projects Administration and the cities of Topeka and Chanute before coming to Hays.

Elmer F. Klement, acting city manager at Fort Atkinson, Wis., since the resignation of **Richard Biehl** last July, has been elected as city manager. A graduate of the University of Wisconsin, school of engineering, Mr. Klement has been city engineer of Fort Atkinson since 1924, and will continue to handle this job along with his new one.

O. J. Eidmann, consulting engineer of Topeka, has been appointed to the Kansas State Registration Board for Professional Engineers, to fill the unexpired term of the late **R. J. Paulette.** Mr. Eidmann received his professional degree from the University of Missouri in 1916, and has practiced in Kansas, both privately and with the state highway commission, since 1919.

Charles B. Braun of New Orleans, regional director of the Work Projects Administration, has taken temporary charge of the Mississippi office pending the appointment of a permanent successor to **Roland Wall,** who has been promoted to assistant regional director at New Orleans. Mr. Braun is also regional director for the states of Mississippi, Alabama, Arkansas, Louisiana, Texas and Oklahoma.

Frank Walter, of Tacoma, Wash., has been appointed engineer of the Intercounty River Improvement Commission, succeeding **B. P. Thomas,** who has resigned.

John McHugh, head of the engineering department in British Columbia of the Dominion Department of fisheries, has retired after 31 years with the department, during the last 28 of which he has been its head.

Paul N. Gillett is now structural engineer in the firm of Smith, Hinchman & Grylls, architects and engineers, Detroit. After graduation from Michigan State College in 1938, Mr. Gillett was with the National Bureau of Standards, the Corps of Engineers, and most recently in the Office of the Chief of Engineers, U. S. Army, with the anti-aircraft defenses branch of the fortification section.

A. B. Herndon, who has been in private engineering practice in Central Florida for many years, was recently appointed city engineer of Orlando. Mr. Herndon was actively engaged in handling some of the first paving and sewerage systems for Orlando and Orange counties. One of the outstanding achievements of

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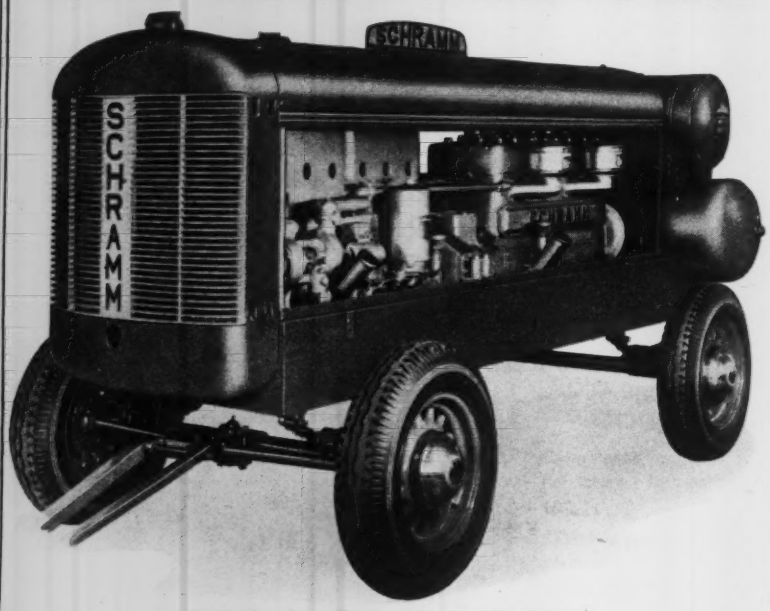

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DEALERS IN PRINCIPAL CITIES

the city's engineering staff, under his direction, has been the turning over and adapting to Army Air Corps needs of the Orlando Municipal Airport, now a Class 4 airport.

Walter Hahn, Jr., former chief inspector of the Solano County (Calif.) Planning Commission, now fills the newly created post of county road engineer. **Harry Shatto,** of Vallejo, has been appointed his assistant in the Vallejo area.

Charles G. Ashby, of Elkin, N. C., has just been appointed district highway engineer of the North Carolina Highway and Public Works Commission, to succeed Thomas A. Leeper, deceased. Mr. Ashby has been connected with the highway construction department since 1925. **J. L. Atwell** of Lenoir, N. C., succeeds him as maintenance engineer for the district.

A. P. Hancock accepted the position of city manager of Amarillo, Tex., effective October 1. Previously he has acted as city manager-city engineer for Kerrville and Crystal City, Tex.

John W. Ross, formerly vice president of Albert B. Ashforth, has joined the William L. Crow Construction Co., New York, as head of the new business department.

Edward M. Beardslee, civil engineer, who was chief engineer on the anti-aircraft firing center at Hinesville, Ga., and later project engineer on the triangular division camp at Augusta, Ga., has resigned his position at the latter camp to return to private practice. Prior to his work on the two camps mentioned, site planning and industrial engineering were Mr. Beardslee's specialty. He has joined the staff of Hentz, Adler, and Shutze, architects, in Atlanta, Ga.

W. W. Towne, South Dakota state sanitary engineer, has left to become assistant professor of sanitary engineering at the University of Missouri.

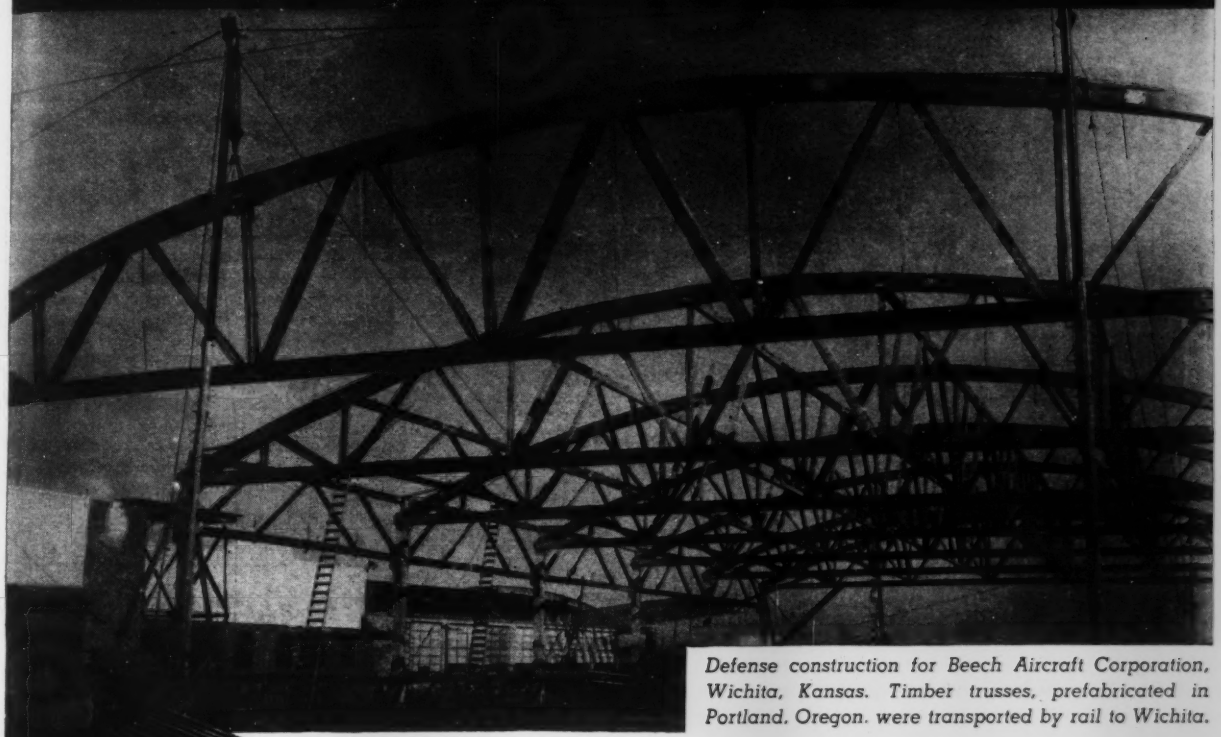
K. M. Allen of North Wilkesboro, N. C., has been retained by that city to make surveys and preliminary cost estimates of a proposed two-lane paved boulevard in the Finley Park section of town.

Gilbert C. White, of Durham, N. C., has been named consulting engineer for a new billion-gallon reservoir to be built near Greensboro, N. C., for the Proximity Manufacturing Co.

Arvid Backlund, formerly district WPA engineer in Minot, N. D., has accepted a civil service appointment to the U. S. Engineer Department and will be located at Santa Ana, Calif.

BEECH AIRCRAFT PLANT

8 acres of timber trusses in 60 days



Defense construction for Beech Aircraft Corporation, Wichita, Kansas. Timber trusses, prefabricated in Portland, Oregon, were transported by rail to Wichita.

TECO Ring Connectors spread the load on a timber joint over practically the entire cross-section of the wood.

Through the TECO System of timber construction, structures like this may be prefabricated at low cost for all types of plants. The Beech Aircraft job took 28 140′ trusses, each designed to carry 180 tons and 28 100′ trusses. Only 30 interior columns were needed in the whole structure which covers 356,000 square feet. From date of order to completion of erection—60 days!

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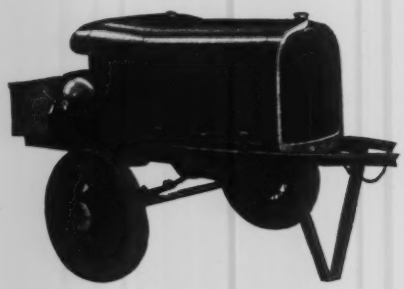
A utility company in Pittsburgh uses 31 Smith Compressors. Words of praise come from users everywhere. These are typical: "I am very well pleased with my compressor. I believe it is one of the best pieces of equipment I have ever bought." Signed, A. R. Welsch, Contractor, Joliet, Ill.



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AIR COMPRESSORS

MEETINGS

INDUSTRIAL HYGIENE FOUNDATION, 6th annual meeting, Mellon Institute, Pittsburgh, Pa., Nov. 12-13.

NATIONAL RIVERS AND HARBORS CONGRESS, Miami, Fla., Nov. 13-14.

HIGHWAY RESEARCH BOARD, 21st annual meeting, Johns Hopkins University, Baltimore, Md., Dec. 2-5.

REGIONAL AND LOCAL MEETINGS

ILLINOIS ASSOCIATION OF HIGHWAY ENGINEERS, 1941 convention, Abraham Lincoln Hotel, Springfield, Ill., Nov. 9.

TENNESSEE VALLEY SECTION, Am. Soc. of C. E., Fall meeting, Knoxville, Tenn., Nov. 14-15.

NEBRASKA IRRIGATION ASSOCIATION, annual convention, Kearney, Neb., Dec. 8-9.

CAROLINAS BRANCH, AMERICAN GENERAL CONTRACTORS, 21st annual convention, Sir Walter Hotel, Raleigh, N. C., Dec. 11-12.

ELECTIONS AND ACTIVITIES

AT THE EIGHTH ANNUAL MEETING of the Canadian Institute of Sewage and Sanitation, held at Kitchener, Ont., W. L. McFaul, city engineer of Hamilton, Ont., was elected president for the coming year, and Dr. A. E. Berry, chief sanitary engineer to the Ontario Government, was re-elected secretary-treasurer.

ARMANDA SANCTRACRUZ, JR., director of technical control in the Mexican Government's department of communications and public works, delivered the principal address at the annual meeting of the Texas Section, American Society of Civil Engineers, which was held at Fort Worth, Tex. on Oct. 30-Nov. 1. The subject of Mr. Sanctracruz's address was a description of the city planning work being carried on in Nuevo Laredo, Mexico.

Other speakers on the program included: G. F. Harley, regional director of the Defense Public Works Division; J. C. Douglass, state director, Public Works Reserve; Charles O. Quade, assistant resident engineer on the bomber project at Fort Worth; Lawrence Ortolani, senior laboratory engineer, Texas State Highway Department; A. E. Dyatt, CAA airport paving engineer; C. J. Harkrider, of the Defense Public Works; Bernard J. Smith of the Public Works Reserve and representatives of the OPM and OEM from Dallas, Tex.

NEW OFFICERS of the Minnesota Association of Architects for the year 1941-1942 are: Wilbur H. Tusler, of Minneapolis, re-elected president; J. C. Taylor, of Hibbing, 1st vice president; Al Mein-

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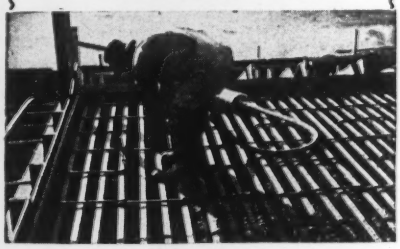

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ecke, of Austin, 2nd vice president; Hal Fridlund, of St. Paul, re-elected secretary-treasurer.

ALFRED MERRITT SMITH, Nevada state engineer, has been elected new president of the Association of Western Engineers at the annual convention of this body held last month at Phoenix, Ariz. Mr. Smith succeeds Don McBride, Oklahoma water resources director as president of the organization. Wardner G. Scott, Nebraska state engineer, was chosen vice president. A resolution was passed at the meeting demanding that "all water utilization work financed or constructed by federal departments be subject to the water laws of the state in which they are located.

E. J. PEARSON, of Minot, N. Dak., was elected president of the North Dakota Water and Sewage Works Conference which was held at Jamestown on Oct. 12-15.

THE NEW PRESIDENT of the California Sewage Works Association is Fred D. Bowlus, resident engineer of the Los Angeles County Sanitation Districts. Carl M. Hoskinson, acting superintendent of the city water department in Sacramento, Calif. was re-elected 1st vice president, which concluded a three-day convention at Sacramento on Oct. 15. Other officers chosen are: Richard Pomeroy, sanitary consultant of the City of Pasadena, 2nd vice president; Jack H. Kimball, Orange County sanitary engineer, secretary-treasurer; William J. O'Connell, Jr., San Francisco; Wayland Jones, Stockton, San Joaquin County; E. D. Phelps, San Diego; Carl F. Tennant, Los Angeles, and A. J. Castro, Los Angeles as directors.

WHEN 400 WATERWORKS engineers convened at Fort Worth, Tex. on Oct. 13 for the annual four-day convention of the Southwest Division of the American Waterworks Association, the theme of the meeting was "Water Supply for Army Camps and National Defense Projects." Among outstanding speakers at the convention was L. R. Howson, Chicago, president of the American Waterworks Association, and Capt. J. H. Anderson, resident engineer of the Lake Worth Bomber Assembly Plant.

AT A RECENT MEETING of the Engineering Society of St. Paul, Minn. and the Engineers Club of Minneapolis, Major John F. Pritchard, U. S. Army construction engineer at the New Brighton, Minn. ammunition plant, and Major J. H. Hinrichs, who will be in charge of operation of the new plant, described the project, which was received with enthusiasm by the members of the two organizations attending the meeting.

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Sauerman Scraper digs sludge from reservoir and hauls spoil 800 ft. to pile.

This shows a Sauerman Scraper as used for open storage of coal, ore, etc.

FOR more than 30 years, SAUERMAN Slacklines, Drag Scrapers and Tower Excavators have been used all over the world, digging and moving earth, gravel, clay, blasted ore and rock, coal and various bulk materials on thousands of different projects.

On many jobs where materials are to be moved distances between 100 ft. and 1500 ft., a SAUERMAN machine has an advantage over other equipment because it is able to dig, haul and place the material in a continuous, straightline operation, doing away with the expense of rehandling.

SAUERMAN machines are designed in small capacities as well as large. There are light, portable units that can be used profitably to handle 50 to 100 tons per day and there are huge machines that will move as much as 1,000 tons per hour.

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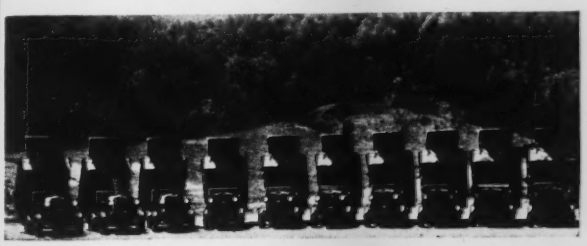

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LINNS FOR DEFENSE

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LINN HAFTRAK FLEETS ARE USED ON THESE DEFENSE PROJECTS:

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Newfoundland Naval Base: *Merritt, Chapman & Scott Corp. and Geo. A. Fuller and Co.* ★ Elwood Arsenal, Elwood, Illinois: *Stone and Webster* ★ Radford and Pulaski, Va.: *Mason and Hanger Co.* ★ Panama Canal Zone ★ Bureau of Public Roads ★ The Tennessee Valley Authority.

All use LINNS because of LINN'S continuing record for reducing haulage costs by means of more speed — more power — stronger bodies and increased payload capacity. That's why they daily cut haulage costs where the going is tough—regardless of the weather—as they have for 25 years. Send for the Catalog.

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CONTOUR-FOLLOWING TRACTION
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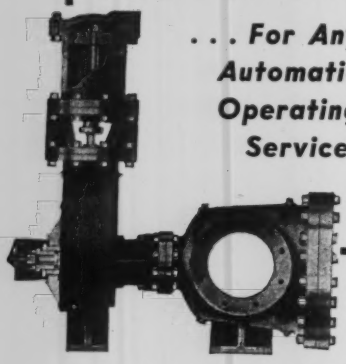
CONE THRU-FLOW VALVES

. . . For Any Automatic Operating Service!



● Here's a valve that does a job for any automatic operating service—the G-A Cone Thru-Flow Valve. Altitude, reducing, check, relief, emergency shut-off . . . all these services, and many more. This valve is also supplied manually operated, in lieu of gate valves. Its construction and design are prime examples of superior GOLDEN-ANDERSON manufacturing methods. In every respect, these valves measure up to the low-operating-cost reputation that has established G-A as the standard of quality for automatic valves specially built for steam and water service.

Choose this G-A Cone Thru-Flow Valve . . . you're always assured of a full line opening without pressure drop. In sizes from 4" to 72".

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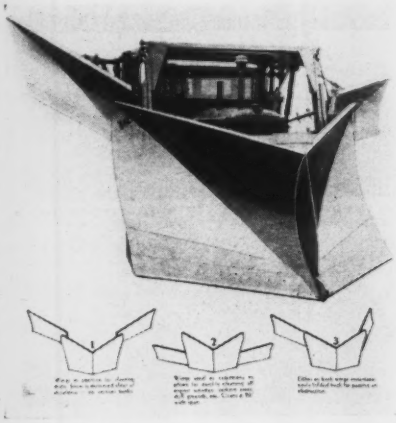
New Aids to the Constructor

Equipment and material announcements and manufacturers' news



Snow Plows

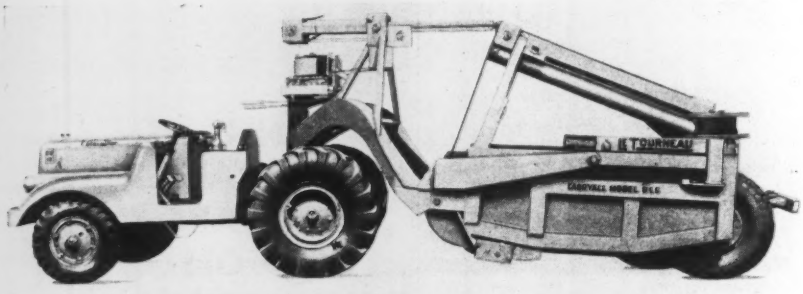
A new line of "V" and side wing plows are now offered by Baker. Made for use with all models of Allis-Chalmers tractors, these husky snow fighters feature independent hydraulic side wing control. By means of two hydraulic cylinders for each wing, positive independent wing operation is provided; front, rear or both ends of wings can be raised or lowered or folded in tight against the tractor while idling or underway. The high "V" plow hugs the front of the tractor and is hydraulically controlled with a four-way valve for raising, lowering, floating or forcing the blade down to cut ice or packed snow. Descriptive bulletins are available from the manufacturer, or AC Tractor Dealers.—*Baker Manufacturing Co., Springfield, Ill.*

Power Control Unit

Buckeye announces an improvement in the design of the control levers and linkage on Buckeye Model HD power control units for Allis-Chalmers, Cletrac, and Caterpillar tractors. The change incorporates relocated horizontal control levers which are placed within easy reach of the operator and improves the leverage which is now simpler and more positive. The fair lead swivel sheaves have been lowered, thus bringing the direct line pull closer to the tractor drawbar, resulting in better traction balance. Complete control lever and linkage assemblies are interchangeable with the older style mechanism and are available for replacing them.—*The Buckeye Traction Ditcher Co., Findlay, Ohio.*

Decimal Equivalent Wall Chart

The new Giant Post Decimal Equivalent Wall Chart is now ready for distribution to those who ask for it on their business stationery. This chart is really new and different, being truly a giant in



LeTourneau Scraper for Caterpillar Wheel Tractor

LeTourneau has announced the Model DLS Carryall Scraper with a rated capacity of 8½ cu.yd. struck and 11 yd. heaped for use with the new DW 10 Caterpillar four-wheel tractor. The Model DLS is very similar to the Model LS, which has proved so successful with the Model C Tournapull. It has the same steeper, longer blade base, which causes material to boil in and flow back into the bowl and forward into the apron; also the same higher sides and built-up apron. Cutting edge is 8 ft., 6 in. long. With the apron cable dead ended on the apron, all hoist and unloading cables are now placed up and out of the dirt, eliminating abrasive cable wear. It is operated by cable from a standard LeTourneau power control unit. The hauling unit is powered by a six-cylinder, water-cooled diesel engine and weighs 14,500 lb. It has five speeds, ranging from 2.4 to 18 m.p.h., to provide plenty of power for loading, and speed for hauling on all earth-moving jobs.—*R. G. LeTourneau, Inc., Peoria, Ill.*

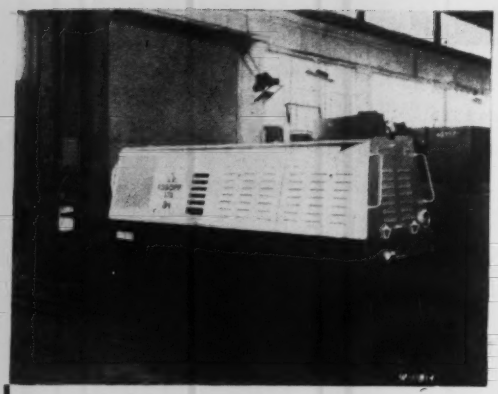
TYPHONITE ELDORADO PENCIL PAGE

Can there be hardness and smoothness in the same drawing pencil? The answer is, "Yes," if the pencil is a Dixon's *Typhonite* Eldorado. This pencil can make a fine line without the usual tendency of a sharp point to cut the paper.

Typhonite Eldorado pencils are smooth even in the hardest degrees because all are made from *Typhonite*. *Typhonite* particles are so minute, even, and controlled in size, that they create a lead without the tiniest jagged edge to tear the paper. *Typhonite* is the finest dry lubricant known to science; hence, the easy smoothness of even the hardest *Typhonite* leads.

We urge you to try Dixon's *Typhonite* Eldorado pencils in your favorite degrees. Judge these pencils by their performance in your hands, doing your work. We are confident of your decision.

PENCIL SALES DEPARTMENT, JOSEPH DIXON CRUCIBLE CO., JERSEY CITY, N. J.



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Diesel power is acknowledged to be the most efficient prime mover available today. Now Whitcomb offers Diesel powered locomotives for mining and tunnel work. Check these advantages: power with more zip, long-life construction, high availability, low operating and maintenance costs. That's why Whitcomb Mine Type Locomotives have established new performance records for underground haulage.

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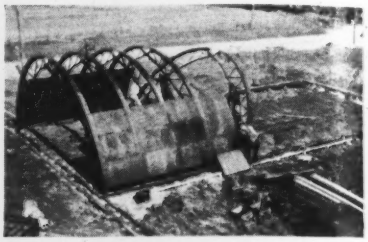
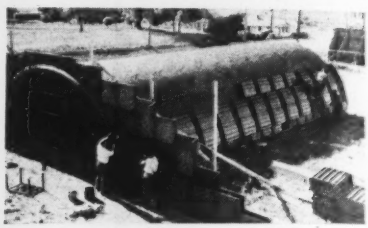
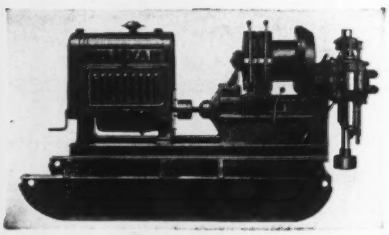
size, 26x39 in., and printed in large heavy type, 1¼ in. high, it can be easily read 50 fet. away. It is printed in two colors, red and black on a white background, making it attractive while the color separation adds to readability. All equivalents are given from ⅛ to 32 of an inch. No obligation, it's yours for the asking.—*The Frederick Post Co., 3650 N. Avondale Ave., Chicago.*





Igloo Forms

Several types of forms and center arch supports have been developed for the 26-ft.x60-ft. concrete igloos being built all over the country for storage of munitions. Picture above is the Economy form being used for construction of igloos for the Navy near Burns City, Ind., these pictures having been made during shop assembly prior to shipping into Navy jurisdiction. Rapid-action fasteners are used throughout to speed both assembly and stripping. The complete shop assembly required only 45 manhours time for plate setters, 52 manhours for helpers.—*Economy Forms Corp., P. O. Box 128, Highland Park Station, Des Moines, Iowa.*



Core Drill

A new heavy-duty core drill, No. 22-HD, is adapted for coal and mineral prospecting, oil field service or testing foundations for heavy construction. This modern drill is built for surface drilling under the toughest of operating conditions, and is conservatively rated at 1750 ft. capacity with "E" rods. This

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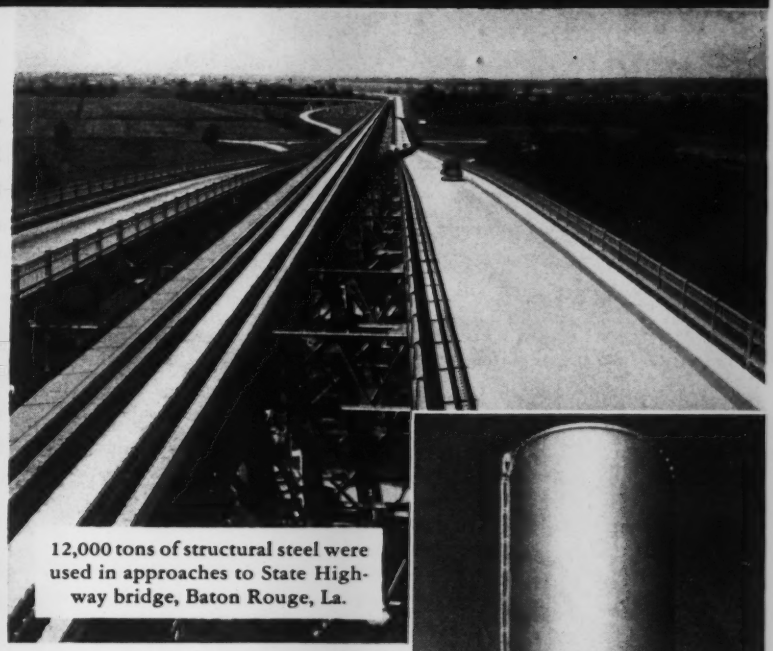
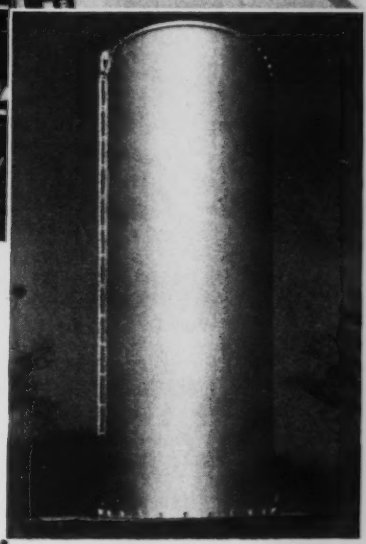
INGALLS—the nation's largest independent fabricator of structural steel and plate work—has long been identified with new achievements, especially the development of a better technique of arc welding.

Our fabricating shops are strategically located at Birmingham and Pittsburgh. The *only* major shipyard in America built *exclusively* for the production of all-welded ocean vessels is our Pascagoula, Miss., plant.

For every type of steel fabrication, construction and erection, Ingalls service is speedy, efficient, modern.



12,000 tons of structural steel were used in approaches to State Highway bridge, Baton Rouge, La.



One of two standpipes (36′ diameter by 93′ 9″ high) built for City of Morganton, N. C.

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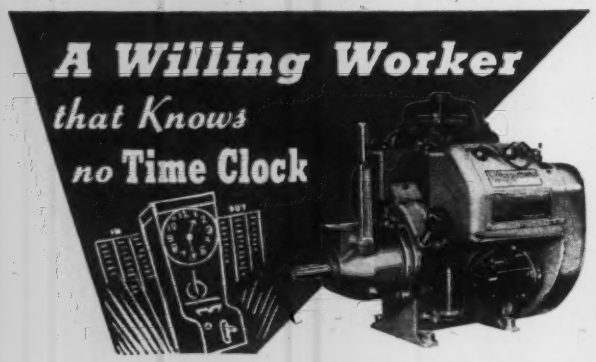

MODEL VE-4
4-cycle, 4-cylinder heavy-duty, air-cooled V-Type Engine.

Today's minutes, properly applied and fully utilized, can make a whale of a lot of difference in tomorrow's production output.

Wisconsin heavy-duty engine power, properly applied and fully utilized, can make a whale of a lot of difference in how much useful work you can crowd into any 24-hour stretch . . . day after day. There is no substitute for heavy-duty power *dependability*. It gets things done when brawn fails.

Use Wisconsin-powered equipment wherever and whenever you can. It pays.

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HEAVY-DUTY AIR-COOLED ENGINES

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A BRIDGE IN PENNSYLVANIA

This photo is of a steel "GUNITED" viaduct over the Lehigh River, and the tracks of the L. V. R. R. and the New Jersey Central tracks, at Coplay (near Allentown), Pa. This job is illustrative of architectural effects possible by the use of "GUNITE".

Many examples of steel encasement by reinforced "GUNITE" are illustrated in our Bulletin 1200, and many other uses are shown. Send for a copy today.

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WE ARE ALSO "GUNITE" CONTRACTORS
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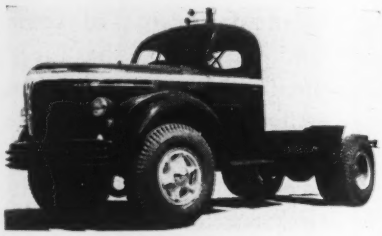
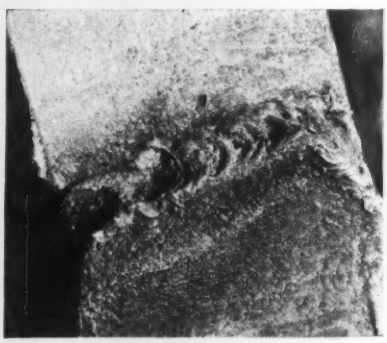
drill is a direct-drive machine with a power unit connected to the drilling head through the four-speed automotive type transmission by means of a clutch. The unit can be quickly dismantled into four main parts for muleback transportation. Ask for Bulletin D-28.—*Sullivan Machinery Co., Woodland Ave., Michigan City, Ind.*



1942 Truck

Modern streamlined gas and diesel-powered truck chassis in gross capacities from 14,000 to 33,700 lb. with tractor and trailer combinations up to 68,000 lb. are included in the 1942 commercial line offered by Reo. Retaining Reo's fundamental principles of design, advancements in the new models are headlined by larger engines with increased torque and correspondingly heavier drive lines. New models are powered by modern six-cylinder, seven-bearing engines ranging in displacement from 228 to 517 cu.in., and having torque capacities of 177 to 369 ft.lb. Reo "More-Load" design is said to accommodate the same pay-load as corresponding commercial units while saving 15 to 20 in. in wheelbase and assuring ideal weight distribution.—*Reo Motors, Inc., Lansing, Mich.*



Galvanizing Welds

Galv-Weld, Inc., is making available to the metal fabricating industry a new process which permits the welding of galvanized or other sheets and structural metal parts, regardless of size, so the joints are left in thoroughly rust-proof condition. Regalvanizing is accomplished at the time of welding and no redipping is necessary. Shown above is a Galv-Weld after four years exposure to weather. National distribution of Galv-Weld materials to licensed users of the

Office view of new addition to the Frederick Post Co. plant

That others may produce .. On Schedule

Defense begins on the drafting engineer's table. Before a plant can be built, he must plan it. Before a tank can be manned, he must see every tread and trigger on paper. He works *first*—quickly, so that others may produce On Schedule.

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Strictly on schedule under heavier and heavier demands are four important POST developments created to help speed up the output of the busy designer and drafting engineer. These four—*P.T.M., Pencil-tex, Master-repro* and *Vapo-paper*—are particularly suited to the Quality plus Speed requirements of today. Have you asked for samples for testing? Ask your nearest POST dealer or write to The Frederick Post Company, Box 803, Chicago.

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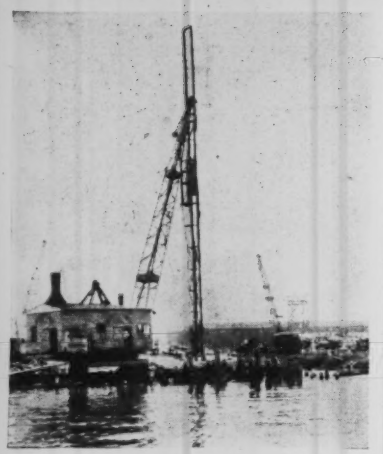

★ Super-Vulcan Differential-Acting Closed-Type Steam Pile Hammers, 1800—3000—5000—8000—working parts are totally enclosed. Overall length reduced to save head room, to permit underwater work.

Super-Vulcan Differential-Acting Open-Type Pile Hammers, 18C—30C—50C—80C—use 25 to 35 per cent less steam per blow—give twice the number of blows per minute—drive more piles per dollar. Simple design, positive action, easy to operate.

Warrington-Vulcan Single-Acting Steam Pile Hammers deliver a moderate frequency of low velocity blows from a relatively heavy ram.

Vulcan Pile Extractors for pulling sheet steel, wood, concrete, H-beams, and pipe piles. Compact — dependable — efficient —rapid in performance.

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patent process is assured through the sales organization and distributors of the Metallic Products Division of the Eagle-Picher Lead Co. of Cincinnati. Immediate deliveries can be made. Full information on the process and license forms are available from—*Galv-Weld, Inc., Mutual Home Bldg., Dayton, Ohio.*

Macks for Panama

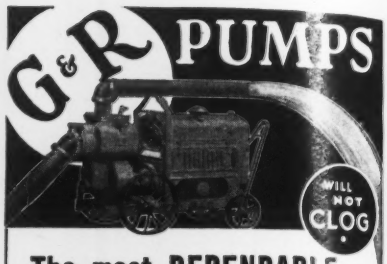
Forty 6-wheel, 4-wheel drive 25 yd. capacity Mack trucks have been shipped to Panama for use on the third set of locks. They are powered by 175 hp. Mack Thermodyne engines driving through a ten-speed transmission to a full floating double-reduction jack-shaft from which chains drive all four rear wheels. Trucks are equipped with eight 14.00 x 12-in. traction lug type tires in the rear. The battleship type body, built by Heil, is 20 yd. water level capacity and is raised by an outboard hydraulic hoist.—*Mack Trucks, Inc., Long Island City, N. Y.*

Internal Cleaner

A cleaner for use in the oil in internal combustion engines, known as Siloo, is now on the market. Recommended for use in the lubricating oil as about a 20 percent addition to dissolve gum and sludge formations and loosen carbon binders, this material is said to be absolutely harmless and free from all injurious acids. Siloo used in the fuel is claimed to clean carburetor jets and fuel lines of gum and sediment and will remove water from the fuel system. Siloo fuel tank solvent eliminates many of the troubles encountered in fuel storage. —*Petroleum Solvents Corp., 331 Madison Ave., New York, N. Y.*

V-Belts

Goodrich announces that as a result of developments in research, it has been able to increase the heat-resisting qualities of its standard V-belts so that they are now capable of use where specially compounded belts were formerly recommended, especially for temperatures above 130 deg. F. The special heat-resisting construction has now been discontinued, and the standard belts for all



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Claims of fastest priming, highest suction lift, more gallons per minute, etc., do not pump water. On the job, the pump must do its own talking, and with dirty water, many a pump is inclined to stutter—and stop.

Let G & R Pumps tell you their own story on any job. They will deliver as much, and usually more, water under any condition, than any other pump. We will ship you one and let you be the judge.

Remember this about G & R Pumps —THEY WILL NOT CLOG—THEY ASK NO TIME OUT. Play safe! That is why more contractors are standardizing on G & R Pumps than on any other make.

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SAFE TRACTION *with* BATESGRATES

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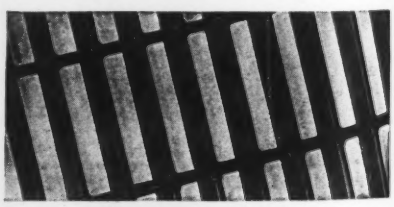
Non-slip, sharp top edge, self-cleaning cross bars like the ridge of a roof give you the maximum in safe traction. Other features your Batesgrate dollars buy are—maximum open area for light and air—no grooves or rough burned metal to catch grease or dirt—fillet weld, the strongest type—no cracks, joints, or crevices, therefore, easily maintained—smooth, clean appearance. Get all the important details from Catalog No. 937—Write today.



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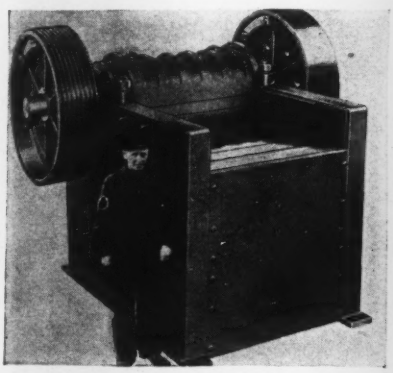
temperatures can be ordered from stock for drives where the heat-resisting belts have been necessary.—*B. F. Goodrich Co., Akron, Ohio.*

Ford Truck

Particularly well adapted to handle heavy machinery and other big loads, the 134-inch Ford platform truck is built strong and tough and it operates with exceptional economy. It's one of seven sturdy platform units in the 1942 Ford line, all of which can be converted to stake types in a few minutes. This unit, with 109 by 87 inches of load space, is available with either a 90 or a 100-horsepower V-8 engine, or with the new 90-horsepower six-cylinder motor.—*Ford Motor Company, Dearborn, Mich.*

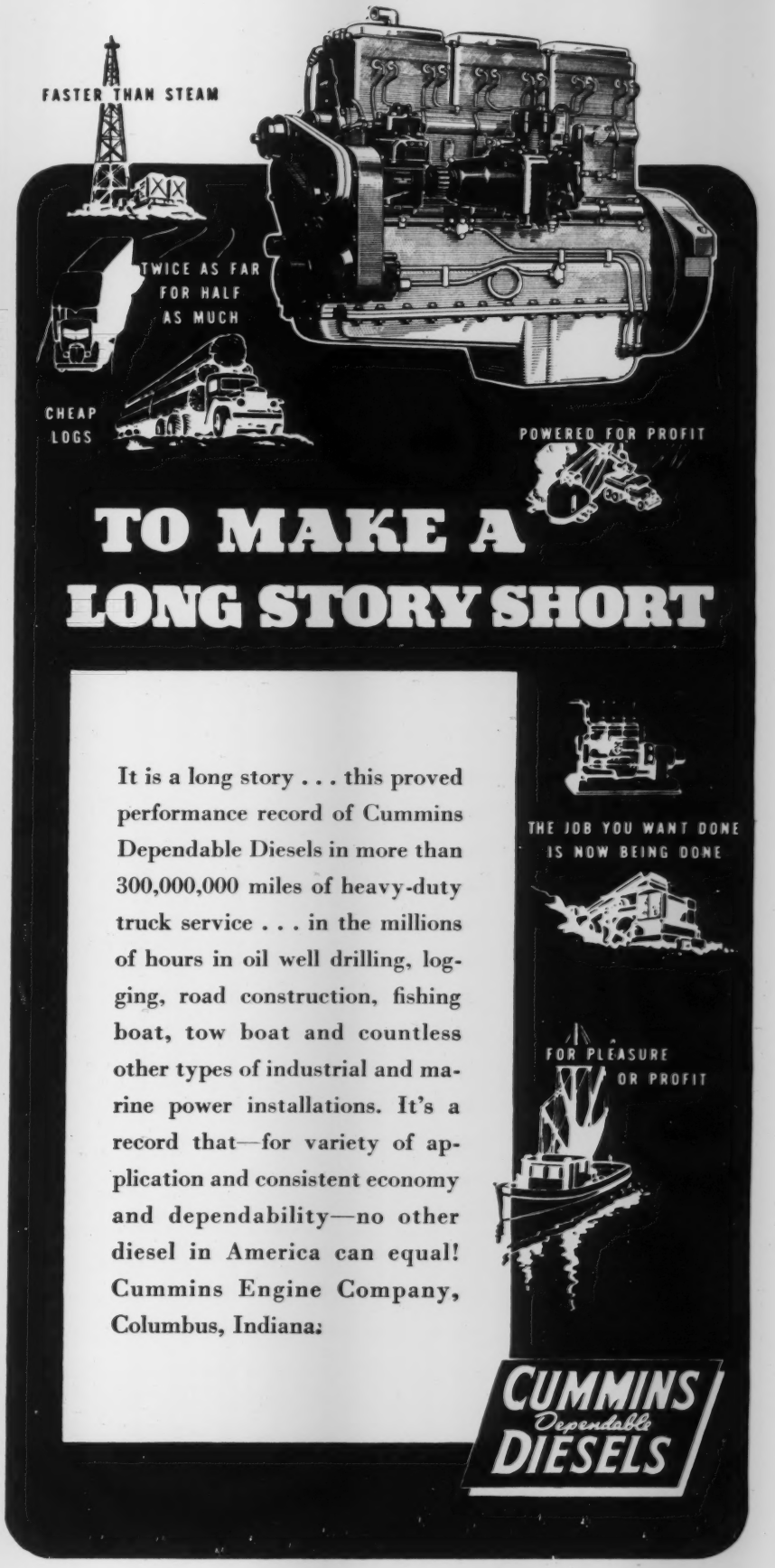


Jaw Crusher

Pioneer has a new and larger jaw crusher. It is new in size, a 30x42-in.; it is new in style, streamlined with a smooth exterior surface; and new in construction with welded steel base. Other features include SKF self-aligning, spherical roller bearings, manganese steel jaws, worm and gear adjusting mechanism and an overhead eccentric.—*Pioneer Engineering Works, Minneapolis, Minn.*

Transformer

A safety transformer that is easily plugged in between the power supply and an electrical extension reduces the voltage to a harmless 6 volts. Thus, the dangers from shock caused by bad sockets or defective extension cords is eliminated. The transformer has a 10-ft. 3-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It is a long story . . . this proved performance record of Cummins Dependable Diesels in more than 300,000,000 miles of heavy-duty truck service . . . in the millions of hours in oil well drilling, logging, road construction, fishing boat, tow boat and countless other types of industrial and marine power installations. It's a record that—for variety of application and consistent economy and dependability—no other diesel in America can equal! Cummins Engine Company, Columbus, Indiana:
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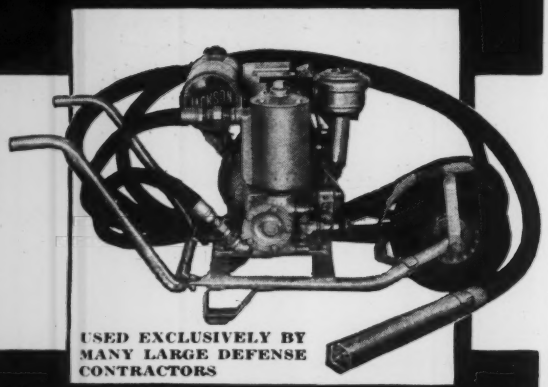
DESIGNED TO "TAKE IT" 3 SHIFTS A DAY—EVERY DAY

- Automatic pressure lubrication—requires no attention.
- 34-ft. hose—2¾" vibrator head.
- Adjustable frequency to 6800 R.P.M.—submerged in concrete.
- Powerful gas engine—4.7 H.P.
- Long-lived, ball-bearing, rotary, hydraulic pump.



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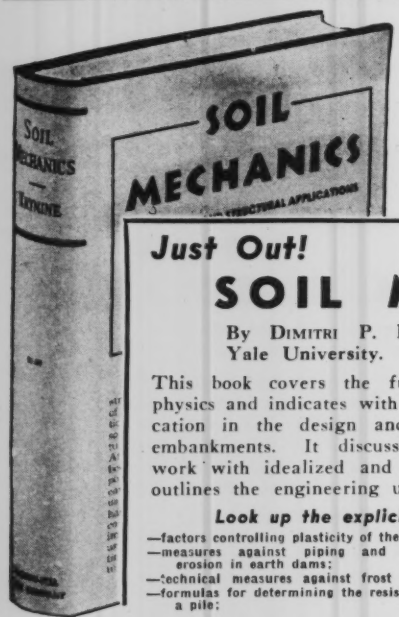

A practical treatment of soil mechanics for construction engineers

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SOIL MECHANICS

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This book covers the fundamentals of soil mechanics and soil physics and indicates with many problems and examples their application in the design and construction of foundations, cuts, and embankments. It discusses laboratory and field tests, compares work with idealized and actual earth masses, and in other ways outlines the engineering uses and limitations of soil mechanics.

Look up the explicit treatment of such topics as:—

—factors controlling plasticity of the soil;
—measures against piping and internal erosion in earth dams;
—technical measures against frost erosion;
—formulas for determining the resistance of a pile;
—adjustment and use of the experimental time-settlement curve;
—shearing test of cohesive soils;
—safety factor in slope design;
—etc., etc.

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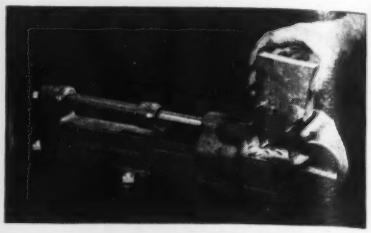
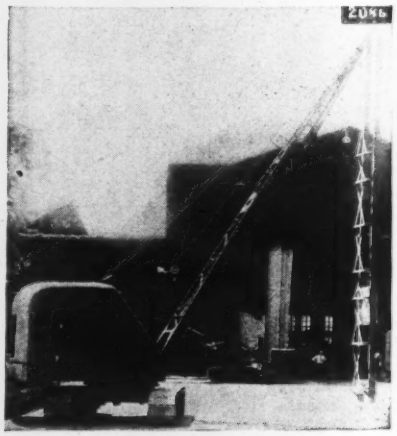
conductor safety type primary cord and a capacity of 50 watts with a 25-foot extension. Known as the Ideal Lo-Volt Transformer, it is available for 110-volt 50 to 60 cycle, or 25 cycle, a.c. current and weighs 4½ lb. — *Ideal Commutator Dresser Co., Sycamore, Ill.*



Hydraulic Vise

Capable of developing pressures up to five tons between the jaws, the new Studebaker hydraulic vise is operated entirely by foot control, permitting the use of both hands in setting up and removing work. The unit is self-sufficient, no outside power being required as pressure is supplied by a foot-pedal pump arrangement in a pedestal mounted on the floor. Stepping on one pedal moves the vise jaw to contact against the work, a second pedal applies pressure up to five tons, and a third pedal releases the jaw. —*Studebaker Machine Co., 9 S. Clinton St., Chicago, Ill.*

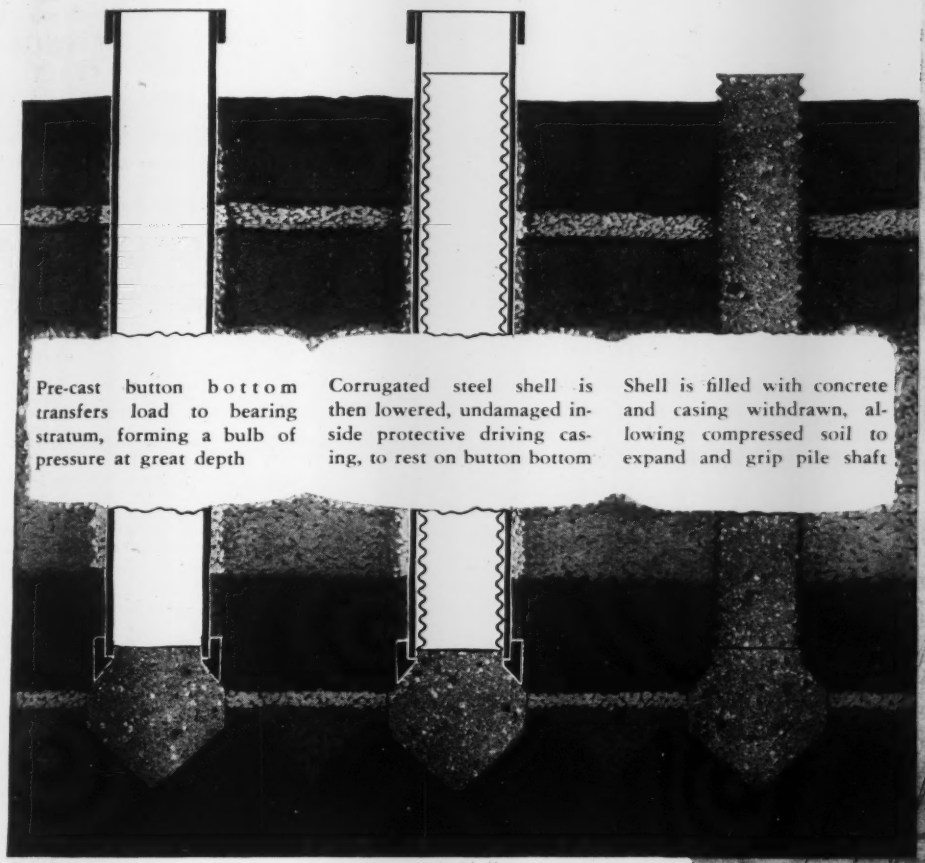


Pile Driver Attachment

A new rugged, yet light, lattice type pile driver attachment, developed by Buckeye, greatly increases the utility of their Clipper Crane. The leads of the unit are suspended from the boom point sheave shaft and are secured in such a way that they can be quickly unhooked. Leads are 30 ft. long and of heavy channel steel construction, to accommodate a 2,000-lb. drop hammer. Pile driver units are available with Model 50, 5-ton; Model 60, 6½-ton, and Model 70, 7-ton Clipper Cranes. — *Buckeye Traction Ditcher Co., Findlay, Ohio.*

BUTTON BOTTOM PILES DRIVEN 73 FEET FOR GENERAL MOTORS

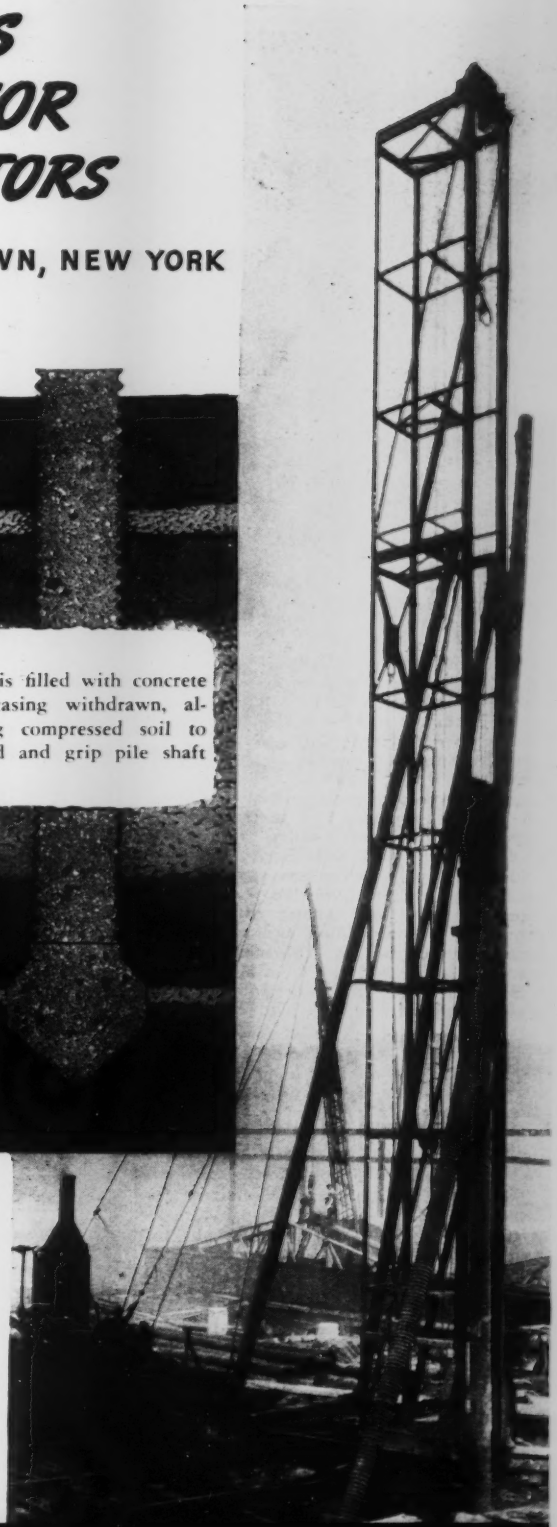
AT TARRYTOWN, NEW YORK



Pre-cast button bottom transfers load to bearing stratum, forming a bulb of pressure at great depth

Corrugated steel shell is then lowered, undamaged inside protective driving casing, to rest on button bottom

Shell is filled with concrete and casing withdrawn, allowing compressed soil to expand and grip pile shaft

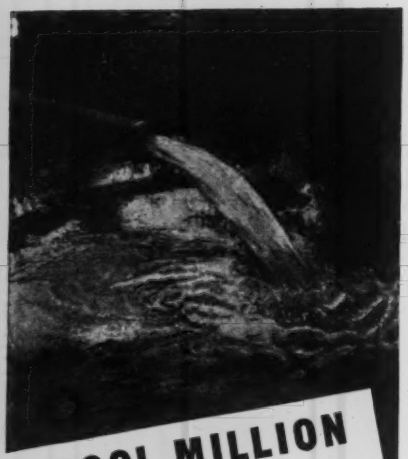


When a firm bearing stratum at great depth must be reached, Button Bottom Piles often provide the surest, easiest and most economical solution.

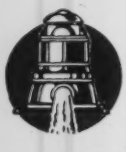
The over-size pre-cast point reduces unit pressure on the bearing stratum and increases its density, thus providing ample carrying capacity from the start. As soil packs back around the shaft, skin friction increases with age, adding still further to safety.

WESTERN FOUNDATION COMPANY
308 W. Washington St., Chicago

WESTERN CONCRETE PILE CORPORATION
52 Vanderbilt Avenue, New York, N. Y.



A COOL MILLION and A Half Gallons Per Day



OVER IN a certain New York town an important airplane gun manufacturer suddenly needed a lot of water for plant operation. No one knew exactly what the water bearing formations below would produce. It was no time to consider the inexperienced. Layne engineers were called in, advised of the urgency and authorized to proceed without delay. In a very few days, the job was completed; well drilled, casing set, pump installed and testing concluded—producing a cool million and a half gallons of water per day. The manufacturer was highly pleased and from somewhere a bottle of champagne was produced and a proper christening took place.

To that manufacturer a very unusual feat had been accomplished. To Layne men, it was just another in a long series of such incidents. In the present day National Defense Emergency, no Layne well water producing undertaking has met with failure. The majority have greatly exceeded the production specified.

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Layne-Ohio Co.	Columbus, Ohio.
Layne-Texas Co.	Houston, Texas.
Layne-Western Co.	Kansas City, Mo.
Layne-Western Co. of Minnesota	Minneapolis, Minn.
International Water Supply	London, Ontario, Can.

NEW PUBLICATIONS

High Speed Earthmoving—Caterpillar Tractor Co. and LaPlant-Choate have collaborated to produce a matched pair of products, the Caterpillar DW-10 rubber-tired wheel tractor and the CW-10 "Carrimor" hydraulic scraper. This unit will load, transport, dump and spread its load quickly and uniformly. This outfit, hydraulic operated, is described and illustrated in a 16-page bulletin which emphasizes the fact that the outfit can be used as either a self-loading or wagon type hauling unit as there are no overhead obstructions to prevent loading by dragline or other means.—*LaPlant-Choate Mfg. Co., Inc., Cedar Rapids, Iowa.*

White Cement—In order to bring the developments in white cement up to date, and provide those who are interested in this cement with a comprehensive review of the many uses of this product, a vest-pocket handbook has been prepared and is offered by Trinity Portland Cement Co. to all who wish to use it. Tests to evaluate the whiteness of different cements are explained, so that anyone can make his own investigation easily.—*Trinity Portland Cement Co., Dallas, Tex.*

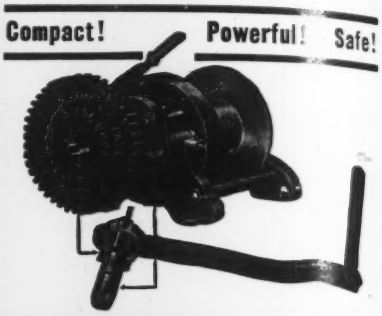
Equipment Cleaning—Information on modern cleaning methods and materials is contained in a 48-page Fleet Operators Cleaning Handbook with uses. Information is given on motor and chassis cleaning, steam vent or vapor cleaning, internal motor cleaning and external cleaning of equipment subject to dirt and grime. Also described is Magnus cement cleaner which completely removes oil, dirt and grease from concrete floors.—*Magnus Chemical Co., Inc.*, 167 *South Ave., Garwood, N. J.*

Steel Forms—A new catalog of steel forms for concrete pouring has been issued by Blaw-Knox. This 60-page booklet is profusely illustrated with construction photographs including many of the big concreting projects. Included in the description are forms for circular, elliptical, horseshoe and box shaped conduits, vehicular tunnels, dams, caissons and bridge centering. The new B-K latch type hand handled form are described. Ask for Catalog 1836—*Blaw-Knox Div. of Blaw-Knox Co., Pittsburgh, Pa.*

Hoists and Derricks—A folder pictures Clyde hoists, derricks and other material available for helping construction in the national defense effort.—*Clyde Iron Works, Inc., Duluth, Minn.*

Tournarope and Tournaweld—A 4-page folder introduces two new Le-

Compact! Powerful! Safe!



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Tourneau products, preformed Tournarope and Tournaweld electrodes which are now available through LeTourneau-Caterpillar dealers. Ask for Form No. G1047.—*R. G. LeTourneau, Inc., Peoria, Ill.*

Roebling—A souvenir booklet tells the story of the John A. Roebling's Sons Co. on the occasion of the 100th anniversary of the company. The booklet traces the rise of the Roebling company and the Roebling family in the business of "Bridging a Century with Wire."—*John A. Roebling's Sons Co., Trenton, N. J.*

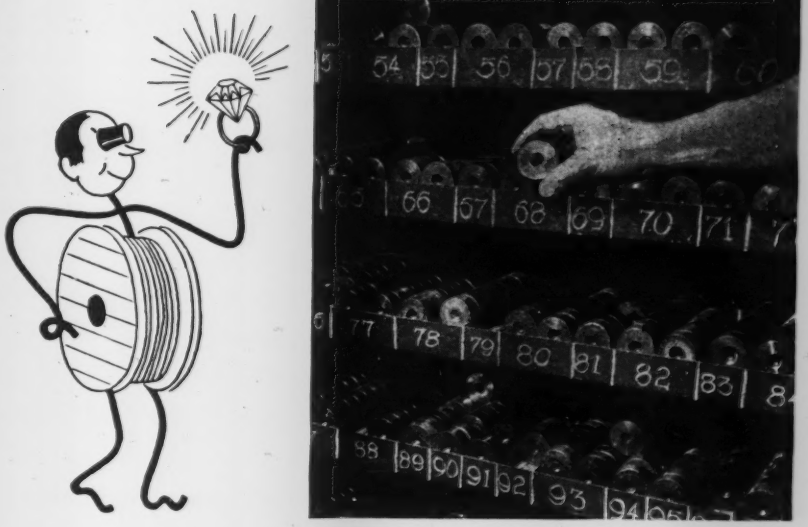
Bulldozers — Baker bulldozers and grade builders for Allis-Chalmers tractors are the subject of a 28-page catalog which illustrates and describes the several models available for use on various sizes of tractors. The hydraulic control system and other details of the machine are completely described.—*Baker Manufacturing Co., Springfield, Ill.*

Sleeve Bearings—A new "Handbook of Sleeve Bearings," by Albert B. Willi discusses the effect of design, alloys and manufacturing methods upon sleeve bearing efficiency, and defines the field of application for each basic type of sleeve bearing. It contains information which engineers, designers and draftsmen will welcome as a constant guide to bearing design and selection. Available to those directly concerned with sleeve bearing installations.—*Federal-Mogul Corp., Detroit, Mich.*

Rubber-Tired Tractor—The new "Caterpillar" diesel DW10 tractor is featured in a profusely illustrated color broadside which covers the tractor's standout features and quotes brief specifications. New standards of production, economy and operator comfort are claimed as Caterpillar sends its heavy-duty, high speed hauling product into a field where Caterpillar machines have long demonstrated their quality and economy.—*Caterpillar Tractor Co., Peoria, Ill.*

Small Light Plant—A folder describes Katolight 110-volt, 60 cycle a.c. single phase units capable of generating up to 5,000 watts. Smallest unit described is a 2,000-watt, two-cylinder air cooled outfit weighing 280 lb.—*Kato Engineering Co., Mankato, Minn.*

Shovel-Crane—A 32-page booklet describes the Bucyrus-Erie 54-B diesel shovel, dragline and crane. Featuring small machine speed with big machine capacity, the catalog completely describes, with excellent illustrations, all working parts of the rig. Complete information is given for the machine as a shovel, crane and dragline.—*Bucyrus Erie Co., South Milwaukee, Wis.*



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Big Motors—For use in central stations, construction projects, and industrial plants, electric motors and controls for cranes, hoists, and gantry bridges are described in a new 20-page booklet announced by Westinghouse. Features of a-c and d-c motors up to 600 hp. for typical materials handling operations are discussed with a note on gear motor applications. A two-page application chart facilitates the selection of motors and control for typical material handling operations. Ask for booklet B-2264. —*Department 7, 7-N-20, Westinghouse Electric & Mfg. Co., East Pittsburgh.*

Welding—A new pictorial booklet "You and Your Job in Arc Welding" describes the course of study offered and the opportunities in learning welding at the Hobart Trade School. A revised edition of the 29 page handbook of welding electrodes and accessories is also available.—*The Hobart Brothers Co., Box EW-79, Troy, Ohio.*

Chisel Steel—A new pamphlet describes Jessop Magic Chisel Steel which is a silicon-molybdenum bearing cold work steel for use where extreme toughness and resistance to fatigue are essential requirements. — *Jessop Steel Co., Washington, Penna.*

Conveyors—A new 24 page booklet describes Pioneer belt conveyors and gives facts, figures and pictures of conveyor units and accessories. Featured is the new Pioneer KD conveyor which are prefabricated steel frame units shipped ready for easy field assembly. Such units are shown to be cheaper to buy, cost less to transport, save time in erection, and are flexible to suit future changes. — *Pioneer Engineering Works, Inc., Minneapolis, Minn.*

Stop Seepage—A new booklet describes and illustrates the use of Volclay for reducing seepage through soil and sand. Volclay is a natural hydrous silicate of alumina, a special kind of bentonite clay which has practically the same constituents as other clay substances but has a unique molecular structure which gives it the ability to absorb many times its own weight of water and swell enormously forming a putty-like mass through which water cannot pass.—*American Colloid Co., 363 W. Superior St., Chicago, Ill.*

Dragline Bucket — Page automatic dragline buckets are described in a folder which pictures the Page automatic digging action and features the Type RM bucket for easy digging, type RC bucket for general work and type RH bucket for difficult work.—*Page Engineering Co., Clearing Post Office, Chicago.*

Manufacturers' Activities

ROY E. JORDAN, president of the Mosaic Tile Co., Zanesville, Ohio, has assumed the duties of manager of the Zanesville plant, succeeding the late A. T. FALCONER. Mr. Jordan's home is in New York City.

THE RANETITE MFG. CO. of St. Louis, Mo., manufacturers of waterproofing and dampproofing compounds, chemicals and coatings, through their southern representative, J. W. PRILLAMAN of Atlanta, Ga., have opened two large jobber accounts, namely: John Lucas & Co. of Tampa, Fla., and the Hall-Stanley Co. of Miami, Fla. These jobbers will supply the dealers throughout the South with as many as fifteen varieties of Ranetite products.

THE RIC-WIL CO., Cleveland, Ohio, manufacturers of insulating conduit systems for underground steam lines, have announced the appointment of FRED BELSER as general manager of the company. Mr. Belser, a graduate of Case School of Applied Science in 1916, has been associated with this company since 1928 in executive capacities. C. GOTTWALD continues as president and treasurer, and M. A. HANNA as vice president and secretary. A. V. DEFOSSET, who comes to his new connection from a previous position with Seiberling Rubber Co., Akron, Ohio, has been appointed publicity director.

C. A. JOHNSON has been appointed general manager of sales, fabricated steel construction, Bethlehem Steel Co., to succeed C. M. DENISE who has resigned because of continued ill health.

WESTERN STEEL PRODUCTS CORP. LTD. has appointed W. S. SPARROW as manager of the western division of the company. Mr. Sparrow will have his headquarters in Winnipeg, Man. F. T. FOXCROFT, manager of the British Columbia territory of the company, is retiring from active business and is succeeded by F. J. WALKER.

TUBE-TURNS, INC., Louisville, Ky., manufacturers of welding fittings, have appointed JACK W. GREEN as manager of their Chicago office and the surrounding territory.

THE WAUKESHA MOTOR CO., builders of heavy-duty internal combustion engines since 1906, have opened a sales office at 414 Joseph Vance Building, Seattle, Wash., with A. G. MULKEY as district manager.

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Why use a large costly 27 E Paver on small paving jobs when this modern, ½ yard mixer will do the work just as well and more economically. Equipped with extra wide open end "paver" skip for speedy truck charging. Famous Smith "End to Center" mixing action. Fast end discharge. Puts paving on a really profitable basis. Ideal for pouring narrow streets, alleys, sidewalks, driveways, etc.

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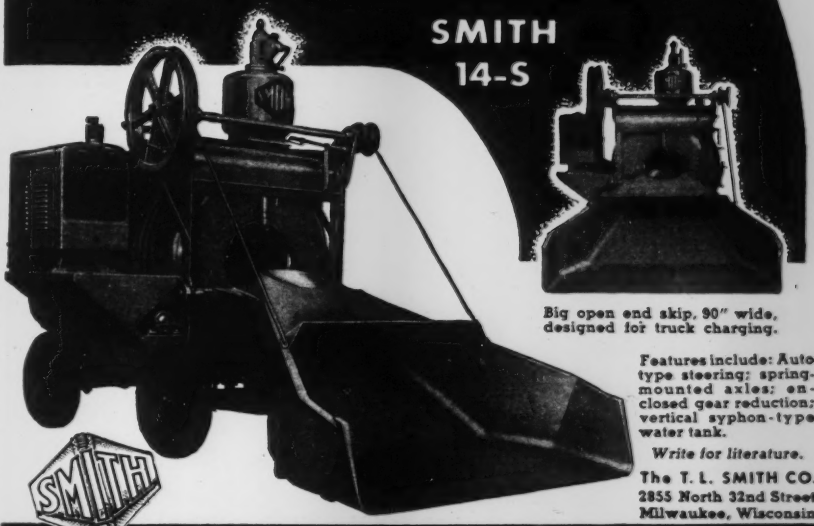

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Features include: Autotype steering; spring-mounted axles; enclosed gear reduction; vertical syphon-type water tank.

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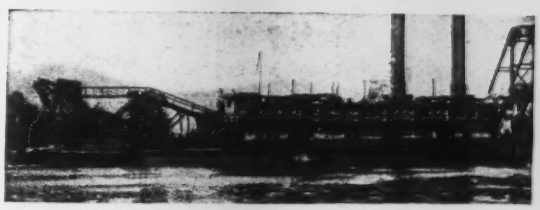

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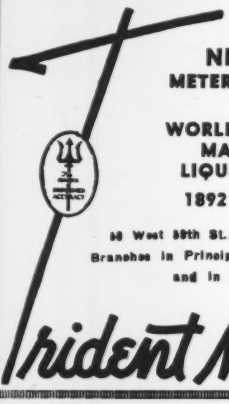

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Location of ENR Correspondents

Symbols and Abbreviations Include:

† Federal Government
★ Project of $500,000 or over
ENR Engineering News-Record
CD Engineering News-Record Construction Daily

Projects—By Size

Construction projects here reported cover the United States and Canada, are of these minimum sizes or larger: water supply, earthwork, waterworks, $15,000; other public works, $25,000; industrial buildings, $40,000; other buildings, $150,000.

Classes of Construction

(Named in order of Listing)

Water Supply
Sewers, Waste Disposal
Bridges, Grade Cross'gs
Streets & Roads
Earthwork, Waterways
Unclassified
Latin America
Public Buildings
Commercial Buildings
Industrial Buildings

Stages Reported

PROPOSED: (except Streets & Roads):

BIDS ASKED (new announcements only. For full calendar, see also preceding issues of ENR);

LOW BIDDERS: All low bidder news will be the final reports published on the projects involved except where award is not made to the low bidder. In this case, a supplementary contract award report will be published.

CONTRACTS AWARDED: Except awards to low bidders previously reported in low bidder stage.

Dates shown are of issue in which last previous report was published.

WATER SUPPLY

PROPOSED WORK

Ark., Prescott—Imprv. WW. $50,000. M. Z. Bair, Gazette Bldg., Little Rock, engr.

Idaho, Nampa—B. H. Waigand, mayor, 2 m.g. rein.-con. water storage tank, 3 mi. pipe line. Seeking WPA funds.

Ia., Whitten—Election Nov. 4, to vote on construction waterworks plant and sys. **$15,000.**

†Ky., Vine Grove—Town, WW sys. addns., extens., imprvs., Docket Ky. 15-104. $15,000. **DPW.**

★**Md., Sparrows Point**—Bethlehem Steel Co., Sparrows Point, soon lets contract, (1st unit) pump sta. and water pipeline. Total est. $2,000,000. Whitman, Requardt & Smith, W. Biddle and Charles Sts., Baltimore, engrs.

†Mass., Chicopee—City, watermains, Docket Mass. 19-104. $320,531. **DPW.**

†Miss., McLaurin—Forest Co. acting for unincorporated village McLaurin, WW and sewerage sys., Docket Miss. 22-1239. $68,000. **DPW.**

†Miss., New Augusta—Perry County acting for unincorporated Village New Augusta, WW and sewerage sys., Docket Miss. 22-138. $82,000. **DPW.** CD 10/21—ENR 10/23.

N. J., East Orange—Sheeting, watermains, $38,500. WPA. W. Willegarod, town engr.

N. J., Newark—Water Dpt., City Hall Annex, sheeting, watermains, Milford and Waverly Aves. **$33,450.** WPA. W. Banks, City Hall Annex, WPA and city engr.

★**N. Y., Buffalo**—Western New York Water Co. H. S. Dewey, vice pres., 11 Niagara St., exten., imprv. water supply and distr. facilities throughout Buffalo suburban dist. $500,000.

N. Y., Lakeville—Water Dist., c/o W. P. Eshbaugh, Geneseo, engr., water supply. Over $15,000.

N. Y., Schenectady—Dpt. P. Wks., City Hall, water supply sys. Over $100,000.

N. D., Portland—Approved $20,000 bond issue, WW imprvs. $30,000. Applied to WPA. Lium & Burdick, Grand Forks, engrs.

O., Newton Falls—Complete water softening sys. and plant, 250,000 gal. tank, pumps, deep wells. $150,000. Applied for DPW grant. C. E. Bricker, 216 High St. N. E., Warren, engr.

★**O., Springfield**—WW imprvs., reservoir, pump. equip., filters, treatment plant addn. $1,000,000. Applied for federal gr. W. E. Lucas, city engr. CD 11/13/40—ENR 11/21/40.

Pa., Montrose—Boro Council, D. Corwin, pres., acquiring, imprv. water supply and distr. sys. facilities of Consumers Water Co. Over $15,000.

†Tenn., Winchester—City WW sys. addns., extens., imprvs., Docket Tenn. 40-104. $69,000. **DPW.** CD 10/6—ENR 10/9.

†Tex., Arlington—City, WW and sewerage sys. addns., extens., imprvs., Docket Tex. 41-219. $125,000. **DPW.** CD 8/12—ENR 8/14.

Tex., Bay City—S. E. Doughtie, mayor, WW sys. $100,000. Applied for DPW funds. Hedrick & Lindsley, 813 Southern Standard Bldg., Houston, engrs.

Tex., Elgin—R. L. Carter, mayor, water and sewer imprvs. $207,800. Applied for DPW funds. J. Montgomery, Littlefield Bldg., Austin, engr.

†Tex., Goose Creek—City, WW sys. addns., extens., imprvs., Docket Tex. 41-112. $124,582. **DPW.** CD 7/28—ENR 7/31.

†Tex., La Marque—Galveston Co. Water Control & Imprv. Dist. 2, $70,000 bond election in November WW sys., wells, elevated and surface tanks, pump unit, main, etc. Docket Tex. 41-265. **$145,000. DPW.** J. J. Rady, Majestic Bldg., Fort Worth, engr. CD 10/16—ENR 10/23.

Tex., San Antonio—Water Works Bd. Trustees, c/o W. D. Masterson, pres., WW imprvs., three 6 m.g.p.d.c. pump plants. $125,000. Applied for DPW funds. CD 8/28—ENR 9/4.

Utah, Clearfield—Clearfield Water Bd., WW imprvs. $44,000. Applied to WPA.

†Utah, Ogden—U. S. Eng., 751 Figueroa St., Los Angeles, Calif., indefinitely postponed bids to have been opened Oct. 24, Pump. Plant 3, Hill Field. CD 10/9—ENR 10/16.

Wash., Seattle—W. C. Morse, water supt., 36 in. watermain, Airport Way from Spokane to Dearborn Sts., and Holgate St. to Beacon Hill. $125,000. C. L. Wartelle, County-City Bldg.

†Alaska, Anchorage—City, water supply line, water distr. sys. exten. $265,000. **DPW.**

†Alaska, Anchorage—City, gravity water sys., Docket Alaska 50-115. $68,510. **DPW.**

Ont., Belleville—Insulating pipe line, Upper Bridge, repairing sand beds, filtration plant, etc. C. A. Mott, City Hall, in association with Gore & Storrie, 1130 Bay St., Toronto, engrs. CD 10/17—ENR 10/23.

BIDS ASKED

Bids Asked November 14

†Tex., Palacios—City, W. C. Gray, city atty., new WW sys., Tex. 41-104. $130,236. **DPW.** J. J. Rady, Majestic Bldg., Ft. Worth, engr.

LOW BIDDERS

Conn., Hartford — Bd. Contr. & Supply, Metropolitan Dist., 550 Main St., Oct. 27. Nepaug Pipe Line 2, Avon and Farmington, from Lock Joint Pipe Co., Newington, **$428,928.** C. M. Saville, 1026 Main St., Hartford, ch. engr. CD 10/7—ENR 10/9.

†D. C., Wash.—U. S. Eng., 1 and Douglas Sts. N.W., Oct. 24, McMillan Reservation South Filtered Water Reservoir, from Euclid Constr. Co., 122 E. 42 St., New York, N. Y. **$339,377.** CD 10/8—ENR 10/9.

O., Medina—Village Bd. Pub. Affairs, 8 and 10 in. watermains, from Mike Fatol, 3553 E. 103 St., Cleveland. **$15,000.** Total est. $65,000. Bids 10/18. E. D. Barstow, 31 N. Summit Ave., Akron, engr. CD 9/16—ENR 9/18.

CONTRACTS AWARDED

★**†Calif., Camp Haan**—Con. Q.M., supplemental water supply from Lake Mathews, incl. Lake Mathews connection, pump plant, main pipe line, connection to Camp Haan water sys., to Morrison-Knudsen Co., 411 W. 5 St., Los Angeles. **$523,944.** CD 10/23—ENR 10/30, under LB.

Ill., Wapella—Water supply and distr. sys. **WPA. $52,000.** Warren & Van Pragg, Inc., 447-450 Standard Office Bldg., Decatur, consult. engrs. CD 9/24—ENR 10/2.

Kan., Kansas City—Fairfax Drainage Dist. Bd., rebuilding pump house, day labor. **$40,000.** Horner & Wyatt, Bd. Trade Bldg., Kansas City, Mo., engrs.

†N. J., Fort Hanock (Highlands) — Con. Q.M., imprv. water supply sys., to Turbine Equipment Co., 75 West St., New York, N. Y. **$73,412.** Bids 10/10. CD 10/7.

N. J., Jersey City—Pennsylvania R.R. Co., W. D. Wiggins, ch. engr., Broad St. Station Bldg., Phila., Pa., watermains, piping, hydrants, etc., Terminal Area, to Farrier Co., 44 Montgomery St., Jersey City. **$15,000.**

N. J., Newark—Water Dpt., City Hall Annex, watermains. **WPA. $32,500.** CD 9/22—ENR 9/25.

SEWERS, WASTE DISPOSAL

PROPOSED WORK

Calif., Los Angeles—Los Angeles Co., Hall of Records, sanitary sewers, Gafford and other streets, Imprvt. 1047. $65,486. A. Jones, Hall of Records, engr.

Calif., Oroville—Sanitary sewerage sys., Oro Vista Area, R.I. 826. $25,000 or more.

†Calif., Paso Robles — City, sewerage sys. addns., imprvs., Docket Calif. 4-221. $49,000. **DPW.** CD 8/13—ENR 8/21.

Ill., Olney — Imprv., exten. sewerage sys. $60,000.

†Ky., Brandenburg—Town, sanitary sewerage sys., sewage treatment plant, repairing water distr. sys., Docket Ky. 15-122. $72,266. **DPW.**

†Me., Bath—City, Pub. Wks. Dpt., City Hall, connecting sewers, Docket Me. 17-111. $22,750. **DPW.** Whitman & Howard, 89 Broad St., Boston, Mass., engrs. CD 10/28—ENR 10/30.

Mich., Niles—Preparing plans sewage disposal sys., intercepting sewerage sys. Shoecraft, Drury & McNamee, Ann Arbor, engrs.

†Miss., Pascagoula — City, sewerage sys. imprvs., treatment and disposal plant, etc., Docket Miss. 22-115. $459,000. **DPW.** CD 10/16—ENR 10/23.

Mo., St. Louis County—Hanley-Page East Sewer Dist. of St. Louis Co., c/o trustees to be selected, $50,000 bond election Nov. 18, sanitary sewerage sys. $153,000. Applied for DPW gr. E. A. Fulton, 3 S. Meramec Ave., Clayton, St. Louis, engr. CD 9/2—ENR 9/4.

†N. J., Dover—War Dpt., 20 St. and Constitution Ave. N.W., Wash., D. C., Imhoff tank, sewage beds, drainage culvert, etc., Picatinny Arsenal. $51,000. WPA. C. Malstrom, Orange and N. 6 Sts., Newark, WPA and owner's engr.

N. J., Newark—24 in. concrete sewer, Prince St. $51,741. WPA. J. Costello, City Hall, WPA and city engr.

N. Y., Cheektowaga—Sewers. Over $25,000. Nussbaumer & Clarke, Inc., Franklin St., Buffalo, engrs.

O., Canton—15 in. sanitary sewer, 4 St. N.E. from Cherry to Young Aves. $29,417. J. A. Shisler, city engr.

O., Cleveland—F. Foy, city pur. agt., three 1,000 ton a week incinerators, northeast, northwest, south sections city. $250,000. J. M. Heffelfinger, 518 City Hall, engr.

O., Findlay — Imprv. sewage treatment plant's facilities for digestion and drying. $50,000. C. C. Gohlke, city engr.

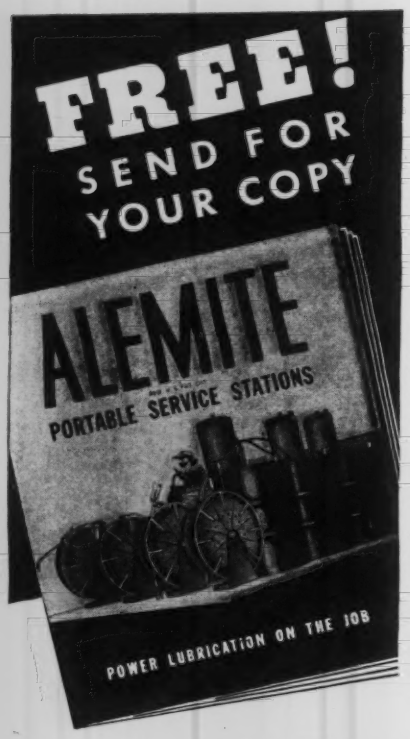
O., Harrison — C. Yeager, mayor, sewers. $30,000.

Ore., Corvallis—Sewage disposal plant. Over $25,000. L. R. Stockman, Baker, engr.

†S. C., North Charleston—North Charleston Pub. Serv. Dist. Comn., exten. outfall sewer, Docket S.C. 38-118. $45,200. **DPW.** John McCrady Co., 9 State St., Charleston, engr. CD 10/7—ENR 10/9.

†S. C., Charleston—City, enlarging, imprv. garbage and rubbish incinerator facilities, Docket S.C. 38-117. $148,400. **DPW.**

Tex., Bay City—S. E. Doughtie, mayor, sewer mains, laterals. $97,900. Applied for DPW funds. Hedrick & Lindsley, 818 Southern Standard Bldg., Houston, engrs.



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SEWERS, etc. (Proposed Work, Cont'd.)

Tex., El Campo—Disposal plant, collecting lines. $80,000. Applied for WPA funds. J. H. Wilkins, Bay City, engr. CD 3/17—ENR 3/20.

†**Tex., Goose Creek** — City, sewerage sys. addns., extens., imprvs, Docket Tex. 41-113. $144,160. **DPW.** CD 7/28—ENR 7/31.

†**Tex., La Marque** — Galveston Co. Water Control & Imprvt. Dist. 2, $65,000 bond election in November, sanitary sewers, disposal plant, 58,000 ft. 4- to 12-in. vitr. clay pipe, etc., Docket Tex. 41-266. $125,000. **DPW.** J. J., Rady, Majestic Bldg., Fort Worth, engrs. CD 10/16—ENR 10/23.

Tex., Laredo—H. S. Cluck, mayor, sanitary sewer imprvs. $385,650. Applied for DPW funds. F. C. Heins, Laredo, engr.

Tex., Robstown—J. Kellam, mayor, storm sewers, inlets, grading, concrete walks, etc. $384,775 voted bonds. Applied for WPA funds. CD 10/6—ENR 10/9.

Wash., Bremerton—Kitsap Co., sewerage sys., Manette peninsula, north of here. $115,000. Federal funds sought. J. H. Pattison, Courthouse, Port Orchard, co. engr.

†**Alaska, Sitka**—City, sewerage sys. Docket Alaska 50-103. $40,410. **DPW.**

†**Alaska, Sitka**—Town, sanitary sewerage sys., Docket Alaska 50-107. $19,328. **DPW.**

Ont., Cornwall—O. Larin, municipality clk., sedimentation type sewage disposal plant, $35,000; sewer under Canadian Natl. R.R. tracks, $25,000. W. H. Magwood, Town Hall, engr.

BIDS ASKED

Bids Asked November 19

†**Tex., Freeport**—Town, R. J. Fields, clk., sewers, sewage disposal plant, Tex. 41-262. $104,877. **DPW.** H. G. Olmstead, Box 1016, Houston, engr. CD 10/16—ENR 10/23.

Bids Asked November 24

†**Tex., Palacios**—City, W. C. Gray, city atty., sanitary sewerage sys., Tex. 41-103. $78,463. DPW. J. Montgomery, Littlefield Bldg., Austin, and J. J. Rady, Majestic Bldg., Ft. Worth, engr. CD 9/4—ENR 9/11.

Bids Asked November 26

†**S. C., North Charleston**—North Charleston Pub. Serv. Dist. Comn., North Charleston, at office John McCrady Co., engr., 9 State St., Charleston, material for sewerage sys. exten., Docket S.C. 38-119. $83,885. **DPW.** CD 9/30—ENR 10/2.

LOW BIDDERS

Calif., Los Angeles—Bd. P. Wks., Oct. 22, rein.-con. blanket along portions North Outfall sewer, from Oberg Bros., 612 E. 80 St. **$54,500.** Est. $64,000.

CONTRACTS AWARDED

Calif., San Diego—Digestion tank, 70 ft. diam., 1 clariflocculator tank, 100 ft. diam. **WPA.** $247,515. B. D. Phelps, City Hall, engr.

Calif., San Luis Obispo—Installing 2,150 ft. 10 in., 3,200 ft. 12 in. vitr. clay sewers, own forces.

†**Calif., Victorville** — U. S. Eng., 751 S. Figueroa St., Los Angeles, sewage treatment plant, Victorville Airport, to Bakker & Robinson, 511 Baseline Ave., San Bernardino. **$87,200.** Bids 10/7, awarded 10/23. CD 10/14—ENR 10/16, under LB.

Colo., Pueblo—Sewerage sys. **WPA. $154,000.** S. A. Elliott, city engr.

N. J., Egg Harbor—Storm drainage sys., brick sewers, manholes, inlets, ditches, water works imprvs. **WPA. $54,021.** CD 10/22—ENR 10/30.

N. J., Jersey City—Hudson Co., Court House, 13,905 ft. 15 in. rein.-con. sewers, 591 manhole frames and covers. **WPA. $53,014.** CD 9/30—ENR 10/2.

N. J., Linden—2,075 ft. 48 in., rein.-con. storm sewer, 340 ft. 24 in., rein.-con. sewer, etc. **WPA. $50,085.** CD 10/15—ENR 10/23.

N. J., Newark—Sheeting, sewers. **WPA. $71,000.** CD 9/22—ENR 9/25.

N. J., Paulsboro—Boro, 1,942 ft. 24- to 48-in. rein.-con. storm sewers, 610 ft. 8-in. auxiliary sewer, appurtenances, Spruce St. and Adams St. **WPA. $66,010.** CD 10/22—ENR 10/30.

N. J., Pennsgrove—Lower Penns Neck Twp., Twp. Hall, 2,900 ft. 12 and 24 in., 8,284 ft. 18 and 24 in. terra cotta storm sewers, etc. **WPA. $54,821.** CD 10/22—ENR 10/30.

N. J., Perth Amboy—Sheeting, vitr. tile and rein.-con. trunk sewers, etc. **WPA, $98,087.** J. H. Weitzen, Smith and Hobart Sts., owner's and WPA engr. CD 10/23—ENR 10/30.

N. J., Princeton—Princeton Twp., Twp. Hall, sheeting, sanitary sewer, Prospect Ave., **WPA. $51,021.** W. D. Cougle, 1102 S. Broad St., Trenton, owner's and WPA engr.

N. J., Stirling—Passaic Twp., Twp. Hall, vitr. tile sanitary sewers, manholes, etc. various streets near ejector station, **WPA. $64,412.** C. Malstrom, Orange and N. 6 Sts., Newark, WPA and owner's engr.

N. J., Trenton—Hamilton Twp., Twp. Hall, imprv. sewerage sys., drainage sys., Whitehorse-Hamilton Square. **WPA. $51,** W. D. Cougle, 1102 S. Broad St., Trenton, owner's and WPA engr.

O., Crestline—City, sewage [illegible] disposal plant, **WPA. $200,000.** F. G. Bro[illegible] Bldg., Marion, engr. CD 5/15.

O., Toledo—Storm, sanitary sewers. **WPA. $359,000.** C. L. Piper, city engr.

Pa., Pittsburgh—F. M. Roessing, [illegible] County Bldg., trunk sewer, Contr. Johnston Hollow, Alluvian St., to R. D. Th[illegible] 5 Ave., **$34,850.** Bids 10/7.

†**Wyo., Fort Francis E. Warren**—[illegible] sewage disposal sys., to Northwestern Eng. Co., Rapid City, S. D. **$63,000.** [illegible] CD 9/30—ENR 10/2.

†**P. R., Guaynabo (Ft. Buchanan)**—[illegible] Q.M., incinerator, to General Eq[illegible] Service, Puerto Rico. **$34,970.** [illegible] CD 10/2.

Que., Sorel—Sewer, Royale Ave., [illegible] labor. **$30,000.** T. Marchand, City Hall, engr.

Sask., Hamlin—Dpt. National Defense for Air, Ottawa, Ont., sewer and water sys., Relief Intermediate Aerodrome, to W. [illegible] Wells Constr. Co. Ltd., Wilkie. **$31,000.**

BRIDGES, GRADE CROSSINGS

PROPOSED WORK

Calif., Bakersfield — Supervs. Kern Co. Court House, rejected bids Oct. 27, 18 span 480 ft. rein.-con. bridge over Kern River, Bellevue Rd. Over $25,000. D. R. Warren, 816 W. 5 St., Los Angeles, engr. CD 10/2[illegible]

★**Ill., Chicago**—Cook Co., County Bldg., 4 grade separations, Penna. R.R. [illegible] Wentworth, Burnham and Torrence Aves., est. $2,450,000; 8 grade separations, Penna. R.R. 167, 154 and 159 Sts., Michigan City Rd., Sibley Blvd., Greenwood and Dolton Aves., 3 bridges, 1 over Little Calumet River, 2 over Thorn Creek, $3,620,000. G. H. Baker, Centennial Bldg., Springfield, state engr. co. roads and city streets.

★**Iowa** and **Nebraska**—City of Sioux City, Ia., bridge over Missouri River between Sioux City, Ia., and South Sioux City, Neb. $1,000,000. Sverdrup & Parcel, Railway Exch. Bldg., St. Louis, Mo., engrs. CD 11/13/40—ENR 11/21/40, under Sioux City, Ia.

◂**Ohio**—State Hy. Dpt., Columbus, bridge, Waterville, Lucas Co. $225,000.

N. Y., Auburn—State Dpt. P. Wks., Albany, steel, concrete hy. bridge over lower end Lake Cayuga. Over $25,000.

N. Y., New York—President Bronx Boro, 851 Grand Concourse, Exterior St. viaduct over Macombs Dam Bridge, $50,000; bridge carrying Grand Concourse over New York Central R.R. between W. 151 and E. 153 Sts., $105,000.

†**O., Massillon**—U. S. Eng., Federal Bldg., Huntington, W. Va., postponed bids to have been opened Oct. 30, steel superstructure for Pennsylvania R.R. bridge over Tuscarawas River. CD 10/7—ENR 10/9.

Pa., Irvona—State Hy. Dpt., I. L. Hughes, secy., Harrisburg, grade crossings to carry Route 234, as relocated over Pennsylvania R.R. and New York Central R.R. tracks, Irvona, and bridge over Clearfield Creek. $119,141. T. C. Frame, c/o owner, ch. engr.

Pa., Plymouth — State Hy. Dpt., Harrisburg, steel, concrete hy. bridge over Susquehanna River, connecting boro of Plymouth with Hanover Twp. Over $100,000. J. L. Herber, Scranton, dist. engr., Hy. Dpt.

Tex., Mercedes — Rio Rica International Bridge, rebuilding concrete, steel toll bridge. $100,000.

Ont., Ottawa—Level crossing on Canadian National R.R., Lyon St. $200,000.

Que., Ormstown—W. G. McGerrigle, municipality clk., bids in spring, reconstructing Jamestown Bridge, approach imprvs. $30,000.

Sask., Saskatoon—Subway, 20 St. $80,000.

BIDS ASKED

Bids Asked November 14

Georgia—State Hy. Dpt., W. E. Wilburn, chn., Atlanta, Jones Ave. Bridge, Atlanta. Bids 8/1 rejected. CD 7/22—ENR 7/24.

New Jersey—E. D. Sterner, comr. State Hy. Dpt., Trenton, P. R.R. Bridge, Rt. 38, east of Bordentown, FAP-FAGS 49 A(1), Burlington Co.

Tennessee—State Hy. Dpt., Nashville, 0.747 mi. bridge, approaches, over Lick Fork Creek, on Non-Sys. Hy., between Pioneer and Jellico, FAP-FAS 3-A (1), Campbell Co.

Bids Asked November 18

Maryland and **Virginia**—State Roads Comm. of Maryland, L. H. Steuart, secy., Baltimore, Md., Contr. 7, fenders for main span piers, Potomac River Bridge, between Ludlow Ferry, Md., and point near Dahlgren, Va. $110,000; adv. ENR 11/6. CD 7/8—ENR 7/10.

BRIDGES, etc. (Continued)

LOW BIDDERS

Connecticut—W. J. Cox, comr. State Hy. Dpt., Hartford, Oct. 27, bridge Salmon Brook, box culvert Monituck Lake, storm sewer outlet, Rt. 10, Granby, from Alexander Jarvis Co., Center St., Manchester. **$50,143;** two 64 ft. span rein.-con. rigid frame bridge, one 54 ft. span plate girder bridge, 9,343 ft. rein.-con. approaches, New London, from A. I. Savin Constr. Co., 10 Village St., East Hartford, **$395,072.** Received no bids Oct. 27, bridge Kent, and bridge Saybrook. CD 10/20—ENR 10/23.

Missouri—State Hy. Comn., Jefferson City, Oct. 24, bridges, Polk and Ozark Counties, from Carrothers & Crouch Constr. Co., 7449 Bway., Kansas City, Mo., **$41,118** and **$46,184** respectively. CD 10/8—ENR 10/16.

Texas—D. C. Greer, engr. State Hy. Dpt., Austin, Oct. 28, Duffan Creek and Little Duffan Creek bridges, Erath Co., from D. Wood, 446 E. Rosewood St., San Antonio. **$26,778.** Est. $27,632. CD 10/20.

★**Virginia** — Dpt. Hys., Richmond, bridge, approaches 1 mi., Stafford and Spotsylvania Counties, from Bowers Constr. Co., Box 1706, Raleigh, N. C., **$555,060;** bridge 1 mi., Stafford Co., from Highway Contractors, Inc., Norfolk. **$50,181.** CD 10/20—ENR 10/23.

CONTRACTS AWARDED

Mississippi — State Hy. Comn., Jackson, overhead bridge, approaches, 0.561 mi. Jefferson Co., to Ed. E. Morgan Co. Inc., Jackson. **$52,201.** Est. $90,000. Bids 10/28, awarded 10/28. CD 10/17.

N. J., Bayonne and **Elizabeth**—Central R.R. Co. of N. J., A. E. Owen, ch. engr., Reading Terminal, Phila., Pa., repairs, renewal fenders railroad bridge over Newark Bay and E. and W. Channels, to G. W. Rogers, 6 Church St., New York, N. Y. **$36,300.**

New York—Chief Engineer, Dpt. P. Wks., Albany, raising Barge Canal Bridge, Saratoga Ave., Saratoga Co., to John Arborio, Inc., West Cedar St., Poughkeepsie. **$75,793.** Bids 9/23. CD 9/2—ENR 9/4.

Utah—State Road Comn., Salt Lake City, concrete T-beam bridge, approaches, 0.687 mi. Wasatch Co., to Miner Bros. Constr. Co., Provo. **$47,503.** Est. $52,314. Bids 10/24. CD 10/16.

Wisconsin—State Hy. Comn., Madison, Oct. 28, Bridge 790, Soelch Overhead, Dane Co., from C. B. Taylor, Decorah, Ia. **$84,750.** CD 10/9—ENR 10/16, under Roads.

Wyoming—State Hy. Comn., Cheyenne, 2 bridges, 8 culverts, Campbell Co., to Etlin E. Peterson, 602 E. 15 St., Casper, **$35,332;** 6 culverts, 2 culvert extens. and 8.626 mi. miscellaneous work, Sweetwater Co., to J. H. and N. M. Monaghan, 332 S. Race St., Denver, Colo., **$31,633.** Bids 10/29. CD 10/20—ENR 10/23.

New Brunswick—Province of New Brunswick, Fredericton, 50 ft. span concrete bridge, Wicklow, to Greenlaw & Estey, Midvale. Est. **$25,000.** Dpt. P. Wks., Fredericton, engrs.

STREETS AND ROADS

BIDS ASKED

Bids Asked November 12

N. Y., New York—President Boro Bronx, Bronx Co. Bldg., 851 Grand Concourse, grading, regrading, curbing, recurbing, landscaping, malls, laying, relaying sidewalks, inlets, basins, drains, culverts, approaches, guard rails, asphalt on concrete paving, Eastern Blvd. underpass, E. Tremont Ave.; grading, curbing, laying sidewalks, crosswalks, removing, trees, inlets, basins, drains, culverts, approaches, guard rails, Lafayette, Metcalf and Noble Aves.

Bids Asked November 13

Florida—State Road Dpt., T. A. Johnson, chn., Tallahassee, grading, Ocala rock base, surface treating 2.074 mi. S. P. 5621(1), Rd. 341, Highlands Co.; regrading, 8 in. shell base surface treating 13.878 mi. S. P. 5433(1) and 5228 (2) Rd. 47, St. Johns Co.; bituminous retread and bituminous surface treating, drainage structures 1.588 mi. S. P. 5002(4) Rd. 164, Hendry Co.; grading, one 180 ft bridge, drainage structures, retread on limerock surfacing, etc. 5.799 mi. S. P. 5450(1) and 5451(1), Rd. 48, Clay Co.; regrading, concrete paving, bridge over Blue Springs Mill Pond, 3.642 mi. F.A.P. SN-FA 3-D(1), Operating 3067, Jackson Co.; clearing, grubbing, grading, concrete paving, twin bridges over Bayou Chico, 0.987 mi. Rd. 341, FAP AN-FA 121-A(1), Operating 3159; grading, clearing, grubbing, concrete paving, bridging, 0.554 mi. State Rd. 341, FA Grade Crossing Project AN-FAGM-WPGM 121-B(1) (On), Operating 4166, both Escambia Co. J. H. Dowling, c/o Owner, state hy. engr.

N. Y., St. George—President Richmond Boro, Boro Hall, bituminous concrete repaving, Lilly Pond Ave. from McClean Ave. to Seaside Blvd.; asphalt block repaving, Benziger Ave. from Westervelt to Monroe Aves.

Bids Asked November 14

†**Calif., Victorville**—U. S. Eng., 751 S. Figueroa St., Los Angeles, constructing streets, Victorville Airport. Over $25,000.

Minnesota—State Hy. Dpt., St. Paul, sand gravel fill, grading, 1 box culvert 9.7 mi. S.P. 1506-01 (Trunk Hy. 92-169), FAS 509 A(1); grading, 3 box culverts, stabilized gravel surfacing 5.7 mi. S.P. 2206-01 (TH 103-124) and S.P. 2407-01 (TH 103-124), FA Projects 919 A(1) and 919 B(1); gravel surfacing, grading, box culverts (Bridges 6352 and 6353), 1.2 mi. S.P. 6903-01 (TH 1-160) and S.P. 6904-03 (TH 1-35), FAP 458 D(1) and S.P. 6913-01 (TH 35-35); gravel lift and backfill, grading 4.9 mi. S.P. 6931-02 (TH 73-163); sand gravel fill, stabilized gravel surfacing 2.7 mi. S.P. 1918-02 (TH 100-117), FAP 570 A(1); furnishing, installing system full traffic-actuated traffic control signals, S.P. 6202-10 (TH 8-63) and S.P. 6204-04 (TH 10-62); S.P. 6212-27 (TH 36-118) and S.P. 6216-06 (TH 51-125); bituminous material, mineral aggregate, gravel surfacing 2.6 mi. State Rd. 11, P. 66-503-1, FAS 701 A(2), Rice Co. J. T. Ellison, c/o owner, ch. engr.

New Jersey—E. D. Sterner, comr., State Hy. Dpt., Trenton, grading, paving 1.767 mi. Kingwood-Byram Rd., Sect. 5, from Graff's Corner toward Byram, FASP-FAS 48-A (1), Hunterdon Co. CD 8/26—ENR 8/28.

Tennessee—State Hy. Dpt., Nashville, grading, drainage 7.157 mi., sect. State Hy. 76, FA¾ 7-A (3), Henry Co.; 4.517 mi. sect. State Hy. 7, SN-FAP 25-A (3), Giles Co.; 11.826 mi. sect. State Hy. 16, AW-FAP 274-B (1), Moore and Bedford Counties; 4.723 mi. sect. State Hy. 10, FAP 491-A (1), Rutherford Co.; 3.333 mi. sect. State Hy. 34, SN-FAP 493-B (1) Knox Co.; grading, drainage, paving 3.520 mi. sect. State Hy. 16, AW-FAP 274-A (1), Coffee Co.; 6.494 mi. sect. State Hy. 8, FAP 283-D (2), Parts 1 and 2 and 283-E (1), Parts 1, 2 & 3, Hamilton Co.; paving 8.545 mi., sect. State Hy. 1, SN-FAP 46-A (4), Dickson Co.; 0.619 mi. Lamar Blvd. from Somerville St. to Central Ave., Memphis, Shelby Co.; widening pavement 1.80s mi. from Greenleaf St. to Daytonia Dr., Red Bank, sect Rt. 29, FAP 231-H (1); 1.309 mi. sect. State Hy. 2, SN-FAP 269-A (2), both Hamilton Co.

Bids Asked November 18

†**Mo., Jefferson Barracks (br. St. Louis)**—Director, Constr. Div., Veterans Admin., Arlington Bldg., Wash., D. C., grading new entrance road for Veterans Admin., Project 2034.

Bids Asked November 19

Louisiana—Dpt. Hys., Baton Rouge, bituminous surface treatment, etc. 2.181 mi. Amite East-Tangipahoa River Hy., SP 913-03-89, Tangipahoa Parish. Bids 10/15 rejected. CD 10/20—ENR 10/23, under Bridges, etc. LB.

Bids Asked November 21

California—State Hy. Dpt., 808 State Bldg., Los Angeles, grading, asphaltic concrete on cement treated paving 3.2 mi. Route 26, San Bernardino Co.; grading, concrete paving 0.6 mi. Route 19, Los Angeles Co. Over $50,000. C. H. Purcell, 808 State Bldg., Los Angeles, engr.

LOW BIDDERS

Arizona—State Hy. Comn., Phoenix, Oct. 24, imprv. 5½ mi. Benson-Douglas Hy., Cochise Co., from J. S. Maffeo, P. O. Box 39, Bisbee. **$31,439.** CD 10/16.

California—C. H. Purcell, engr. State Hy. Dpt., P. Wks. Bldg., Sacramento, Oct. 22, imprv. 14 mi. and 0.3 mi. hy. Shasta Co., from A. Teichert & Son, Inc., 1846 37 St., Sacramento. **$320,330.** CD 10/7—ENR 10/9.

Calif., San Bruno—Imprv. Mills Park Subdivision 2, from L. C. Smith, 1 St. and Railroad Ave., San Mateo. **$31,767.** CD 10/17—ENR 10/23.

Colorado—State Hy. Dpt., Denver, Oct. 22, imprv. 1.382 mi. Summit and Clear Creek Counties, from E. H. Honnen, Shawnee St., Colorado Springs. **$198,499.** CD 10/16.

Connecticut—State Hy. Dpt., Hartford, Oct. 27, imprv. 7,809 ft. New Canan, from Cerretani Constr. Co., Inc., 107 Main St., New Canaan, bituminous macadam **$36,925,** Colprovia **$36,635.** CD 10/20—ENR 10/23.

★**Missouri**—State Hy. Comn., Jefferson City, Oct. 24, imprv. 0.536 mi. Polk Co., from Carrothers & Crouch, Constr. Co., 7449 Bway., Kansas City, Mo., **$69,587***4.553 mi. McDonald Co., from J. M. Roark & Poole Constr. Co., Anderson, **$257,225***3.27 mi. Greene Co., from O'Dell & Riney Constr. Co., Hannibal, **$199,681***3.433 mi. Adair Co., from L. W. Riney Constr. Co., Hannibal, **$31,055***2.619 mi. Reynolds Co., from W. J. Meneefee Constr. Co., Sedalia, **$29,656***1.587 mi. Caldwell Co., and 4.49 mi. Ray Co., from Booth & Olson, Inc., 622 Insurance Exch. Bldg., Sioux City, Ia. **$55,204** and **$182,497** respectively*4.694 mi. Wright Co., from Gillioz Co., Monett, **$255,026***CD 10/8—ENR 10/16.

★**Texas**—A. C. Greer, engr. State Hy. Dpt., Austin, Oct. 28, imprv. 1.999 mi. Matagorda Co., from Gulf Bitulithic Co., Box 2096, Houston, **$83,225,** est. $80,909***10.883 mi. Hill Co., and 1.59 mi. Nueces Co., from Cage Bros. and H. E. Williams, Bishop, **$263,904** and **$82,465** respectively, est. $292,966 and $79,228 respec-

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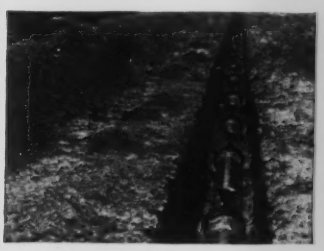

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tively***14.945 mi. Wichita and Clay Counties, from Austin Road Co., 1813 Clarence St., Dallas, **$331,291,** est. $298,778***9.355 mi. Kinney and Uvalde Counties, from Plains Constr. Co., Estelline, **$29,014,** est. $29,410***11.928 mi. Lubbock Co., from J. E. & H. Barnhill, Turkey, **$30,685,** est. $40,070***5.799 mi. Nueces Co., from Heldenfels Bros., Rockport, **$25,283,** est. $24,000***13.516 mi. Hamilton and Erath Counties, from Morgan Constr. Co., 301 Wilson Bldg., Dallas, **$253,778,** est. $275,870***0.377 mi. Montgomery and San Jacinto Counties, from M. E. Worrell, Box 842, Austin, **$161,504,** est. $172,626***6.667 mi. Somervell and Johnson Counties, from F. Hall, Box 1188, Waco, **$83,717,** est. $97,641***11.151 mi. Montgomery and San Jacinto Counties, from Brown & Root, Inc., P. O. Box 3, Houston, **$93,300,** est. $95,541***13.905 mi. Leon Co., from K & S Constr. Co., 2151 Fort Worth Ave., Dallas, **$87,754,** est. $95,392. CD 10/20.

Tex., Ozona—Crockett Co., c/o C. E. Davidson, Ozona, Oct. 24, imprv. 21 mi. roads, from Public Constr. Co., Denton, **$95,982.** CD 10/15.

Virginia—Dpt. Hys., Richmond, Oct. 30, imprv. 1.5 mi. Fairfax Co., from Blackwell Eng. & Constr. Co., Warrenton, **$69,808***1.2 mi. Wise and Russell Counties from R. H. Bolling, Norton, **$76,757***1.6 mi. Nottoway Co., from F. D. Cline, Box 1197, Greensboro, N. C., **$53,882***1.4 mi. Stafford and King George Counties from T. F. Franklin, Bassett, **$29,804***1 mi. Prince George Co., from R. K. Williams, Belleville and Moore Sts., Richmond. **$66,095.** Received no bids Oct. 30, imprv. 0.2 mi. Fairfax Co. CD 10/20—ENR 10/23.

★**Wisconsin**—State Hy. Comn., Madison, Oct. 28, imprv. 0.994 mi. Waukesha Co., from Kramp Constr. Co., Jones Island, Milwaukee, **$117,511***8.649 mi. Monroe Co., from Frank Mashuda Constr. Co., 5556 W. Roosevelt Dr., Milwaukee, **$352,612***2.04 mi., Pierce Co., from Wm. Lathers, Jr., Madison, **$105,683.** CD 10/9—ENR 10/16.

Wash., Colfax—Whitman Co. Comn., Oct. 25, grading, surfacing Uniontown-Moscow Rd., from Carbon Bros., 1004 23 Ave., Spokane, **$36,751.** J. H. Redmond, Courthouse, engr.

CONTRACTS AWARDED

†**Calif., Camp Callan**—Con. Q.M., surfacing Battalion Training areas, to B. G. Carroll & H. L. Foster, 2260 Main St., San Diego. **$92,475.**

Calif., Sacramento—Imprv. Coloma Terrace and Meister Terrace, to A. Teichert & Son, Inc., 1846-37 St., **$33,465** and **$26,541** respectively***Thelma Tract, to McGillvray Constr. Co., P. O. Box 873, **$36,871.** Grand total $96,877. CD 9/3.

†**Ga., Camp Stewart**—Con. Q.M., grading, paving rail head area and traffic circle, to Espy Paving & Constr. Co., 108 E. Bay St., Savannah, **$51,848.**

Mich., Ann Arbor—Washtenaw Co. Road Comn., grading, clearing concrete paving 1 mi. Chase Rd., to E. B. Schwaderer, Cass City, **$43,397.** E. Almendinger, Ann Arbor, co. engr.

★**Mississippi**—State Hy. Comn., Jackson, imprv. 8.171 mi. Lamar and Forrest Counties, to Boyd Constr. Co., Columbia, **$123,025,** est. $200,000***2.17 mi. Jefferson Co., to Ed. E. Morgan Co., Inc., Jackson, **$81,311,** est. $30,000***7.918 mi. Monroe Co., to Hooper Constr. Co., 1125 Kings Ave., South Jacksonville, Fla., **$207,160***8.839 mi. Oktibena Co., to J. B. Michael & Co., 1027 Haywood St., Memphis, Tenn., **$139,696,** est. $170,000***2.083 mi. Tishomingo Co., to Chandler Bros., Inc., Virgilina, Va., **$49,729,** est. $100,000. Grand total $600,921. Bids Oct. 28. CD 10/17.

N. J., Atlantic City—Grading, 4 in. concrete sidewalks, concrete curbs, 4th Ward Sect., **WPA. $62,435.** G. R. Swinton, 930 Atlantic Ave., Atlantic City, WPA and owner's engr.

N. J., Beach Haven—Grading, concrete sidewalks, curbs, gravel sidewalks, various streets, **WPA. $90,606,** W. D. Cougle, 1102 S. Broad St., Trenton, WPA engr.

N. J., Camden—Grading, asphalt paving, **WPA. $70,000.** G. R. Swinton, 930 Atlantic Ave., Atlantic City, owner's and WPA engr.

†**N. J., Fort Monmouth**—Con. Q.M., grading, rein.-con. roads around Squier Laboratories, **WPA. $51,000.** W. D. Coulge, 1102 S. Broad St., Trenton, WPA and owner's engr.

N. J., Hackensack—Bergen Co., Administration Bldg., grading, granite block shoulders, masonry walls, concrete curbs, drainage, etc., **WPA. $51,250.** C. Malstrom, Orange and N. 6 Sts., Newark, WPA engr.

N. J., Jersey City—Hudson Co., Court House, grading, relaying 17,664 sq. yd. stone block pavements, **WPA. $61,824.** F. Radigan, Court House, WPA and co. engr.

N. J., Jersey City—Hudson Co., Court House, resetting existing bluestone sidewalks, constructing 5 in. concrete sidewalks, **WPA. $60,500.** F. Radigan, Court House, co. engr.

†**N. J., Metuchen**—War Dpt., 20 St. and Constitution Ave. N.W., Wash., D. C., grading, 7 in. penetration macadam surfacing, imprv. grounds, Raritan Arsenal, **WPA. $62,902.** J. H. Weitzen, Smith and Hobart Sts., Perth Amboy, WPA and owner's engr.

N. J., Montclair—Grading, 3 in. [illegible] surfacing, curbing, **WPA. $51,500.** [illegible] H. Harden, town engr.

N. J., Newark—Street Dpt., City [illegible] ing, paving, catch basins, etc., Dev. [illegible] **WPA. $68,250.** G. Andress, City [illegible] and owner's engr.

†**N. J., Pedricktown**—War Dpt., [illegible] St. and Constitution Ave. N.W., Wash., D. [illegible] facing, oiling, graveling, etc. Delaware Ordnance Depot. **WPA. $57,000.** G. R. Swinton, 930 Atlantic Ave., Atlantic City, WPA and owner's engr.

N. J., Salem—52,720 ft. 6 in. concrete [illegible] 120,000 ft. 4 in. concrete sidewalks, [illegible] **WPA. $61,000.** G. R. Swinton, 930 Atlantic Ave., Atlantic City, WPA and owner's engr.

N. C., Morganton—C. F. Lewis, city engr., imprv. streets, **WPA. $118,461.**

O., East Liverpool—Widening, resurfacing Pennsylvania Ave., **WPA. $100,000.** G. Bloomgren, city engr.

★**Pennsylvania**—State Hy. Dpt., Harrisburg, imprv. 39.43 mi. hys., bridges, Allegheny, Armstrong, Beaver, Bedford, Berks, Blair, Fayette, Juniata, Lackawanna, Lehigh, Monroe, Northampton, Schuylkill, Somerset, Susquehanna Wayne and Wyoming Counties, Pennsylvania State Work Relief Administration, H. R. Davidson, administrator, State Capitol, Harrisburg. **$821,323.** T. [illegible] Frame, c/o Owner, ch. engr.

Pa., Bellefonte — Boro Council, grading, curbing, guttering, walks, paving, guard rails, etc. own forces. **$25,000.**

Pa., Pittston Twp. (Pittston P.O.)—Superv. Pittston Twp., Pittston, grading, stone base, bituminous surfacing major thorofares, **WPA** under supervision W. F. Snyder, Dist. **WPA** dir., Scranton. **$100,000.**

Tex., Bastrop—Bastrop Co., c/o C. B. Maynard, judge, Bastrop, constructing, imprv. 8.5 mi. road from Travis Co. line, **WPA. $68,000.**

Tex., Floydada—Floyd Co., c/o G. C. Tubbs, judge, imprv. 7 mi. Hy. 207. **WPA. $55,700.** A. S. Cummings, Court House, engr.

Tex., Lockhart—Street imprvs., **WPA. $85,399.**

Tex., Lufkin—Angelina Co., c/o Judge, reconstructing, imprv. roads, bridges, **WPA. $124,926.**

Tex., McAllen—Street repairs and paving, etc., **WPA.** Approx. **$50,000.**

Tex., New Braunfels—Street imprvs., **WPA. $94,476.**

Tex., Paris—Lamar Co., c/o E. F. Harrell, judge, constructing, imprv. rural roads, **WPA.** $81,900. J. N. Roddy, c/o Court House, engr.

Vermont—State Hy. Dpt., H. E. Sargent, ch. engr., Montpelier, imprv. 4.765 mi. FAS 172-B (1), Rt. 30A, Shoreham and Orwell, to Derrick De Groot, Jericho. **$125,151.** Bids 10/17. CD 10/7—ENR 10/9.

West Virginia—State Rd. Comn., Charleston, imprv. 0.53 mi. Fayette Co., to G. H. Siems & Co., Oak Hill, **$39,369***1.47 mi. Marion Co. and 1.266 mi. Wood Co., to Keeley Constr. Co., Clarksburg, **$160,830** and **$125,252** respectively ***3.181 mi. Ritchie Co., to Harry Hatfield & Co., Barboursville, **$83,444.** Grand total $408,895. Bids 10/28, awarded 10/29. CD 10/17—ENR 10/23.

Wyoming—State Hy. Comn., F. Kelso, supt., Cheyenne, imprv. 8.626 mi. Sweetwater Co., to Northwestern Eng. Co., Rapid City, S. Dak., **$162,280***18.699 mi. Campbell Co., to Sharoock & Pursel, Casper, **$174,707***2.564 mi. Uinta Co., to Wyoming Constr. Co., Box 717, Laramie, **$47,003.** Grand total $383,990. Bids 10/29. CD 10/20—ENR 10/23.

Ont., Copenhagen—Elgin Co., St. Thomas, 5 mi. road work, day labor. **$40,000.** F. A. Bell, County Bldg., St. Thomas, engr.

Que., Port Alfred—Province of Quebec, Quebec City, graveling 4 mi. roadway, day labor. **$32,000.** E. Gohier, Dpt. Roads, Quebec City, engr.

EARTHWORK WATERWAYS

PROPOSED WORK

†**Minnesota**—U. S. Eng., P. O. and Custom House, St. Paul, rejected bids Oct. 14, constructing Marsh Lake Dam imprvs. and stage recorder house, Lac qui Parle Dam, Lac qui Parle Reservoir, Minnesota River. Will readvertise. CD 10/22—ENR 10/30, under LB.

N. J., Leonardo—State Bd. Commerce & Navigation, 1060 Broad St., Newark, jetties, bulkheads to protect Leonardo Lagoon from beach erosion. $80,000. C. W. Staniford, 1060 Broad St., Newark, engr.

N. J., Newark—Essex Co. Park Comn., 115 Clifton Ave., excavating, sheeting, paving bottom, rubble masonry walls, etc. streams. $38,500. WPA. R. D. Crater, 115 Clifton Ave., engr.

†**Oregon**—Bureau Reclamation, Bend, rejected bids Sept. 15, north unit canal crossing Crooked River, vicinity Smith Rocks. $150,000. CD 8/19—ENR 8/21, under Bridges.

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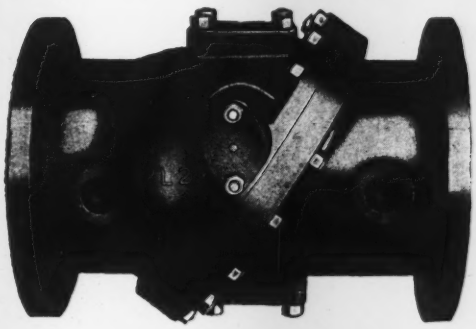

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EARTHWORK, etc. (Proposed Work, (Cont'd.)

S. D., Sioux Falls—Minnehaha Soil Conservation Dist., soil and water conservation, drainage, 141,021 acres farm land, Minnehaha Co.

BIDS ASKED

Bids Asked November 10

N. Y., North Beach—Comr. Parks, Dpt. Parks, Arsenal Bldg., 64 St. and 5 Ave., New York, Contr. Q-84A-441, excavating materials from Jackson's Creek Drainage Channel and placing rip-rap, LaGuardia Airport, Queens Boro.

Bids Asked November 12

N. Y., New York—Comr. Parks, at office Dpt. Parks, 64 St. and 5 Ave., Central Park, earth fill and rip-rap bulkhead, etc. Sound View Park, Bronx Boro. CD 9/30—ENR 10/2.

Bids Asked November 13

Massachusetts — Commonwealth Mass., Metropolitan Dist. Comn., Parks Div., 20 Somerset St., Boston, rebuilding portion concrete seawall, Lynn Shore Reservation, Lynn, $15,000; Winthrop Shore Reservation, Winthrop, $20,000; Nantasket Beach Reservation, Hull, $6,000.

†**Massachusetts**—U. S. Eng., Park Sq. Bldg., Boston, dredging approx. 73,750 cu. yd. material in Mystic River, Inv. 175-42-56.

Bids Asked November 17

†**Arizona—California**—Bureau Reclamation, Customhouse, Denver, Colo., furnishing, del., structural steel for bus-structure assembly for bays Y1 to Y6, (inclusive) of 161 kv. switchyard, Parker power plant, Parker Dam power project, Spec. 1586-D.

Bids Asked November 25

†**Tex., Freeport**—U. S. Eng., Federal Bldg., Galveston, floodgates, bldgs., site of intersection Intercoastal Waterway and Brazos River, approx. 4 mi. southwest of here.

Bids Asked About November 28

†**Pa., Plymouth**—U. S. Eng., 332 Post Office Bldg., Baltimore, Md., pump. stations. CD 9/22—ENR 9/25.

Bids Asked November 28

†**Mississippi**—U. S. Eng., Federal Bldg., Mobile, Ala., dredging 1,650,000 cu. yd. material from Gulfport Ship Channel in Mississippi Sound. $150,000.

Bids Asked

†**California**—U. S. Eng., 208 Post Office Bldg., Sacramento, enlarging, raising, strengthening existing levee and constructing appurtenant works along west levee Reclamation Dist. 2068, 5.5 mi., incl. 265,000 cu. yd. excav., Inv. 1105-42-13. Date not set.

Tex., Arkansas Pass—City, M. W. Clayborn, mayor, seawall protection, rein.-con., steel seawall, 15 ft. high, fill-in behind present seawall, boat basin, etc. $450,000. Tamm & Fitzgerald, Harlingen, engrs. CD 11/8/40—ENR 11/41/40.

LOW BIDDERS

†**Missouri**—U. S. Eng., Clock Tower Bldg., Rock Island, Ill., Oct. 20, imprv. levees Union Twp. D.D., Lewis Co., near La Grange, from Wapello Constr. Co., Wapello, Ia., **$49,151.** Est. $33,732. CD 10/6—ENR 10/9.

CONTRACTS AWARDED

†**California**—Bureau Reclamation, Customhouse, Denver, Colo., furnishing four 102 in. conduit tube valves for installation in river outlets, at Shasta Dam, Kennett Div., Central Valley Project, Spec. 991, to Hardie-Tynes Mfg. Co., 800 N. 28 St., Birmingham, Ala., **$380,000;** 4 sets conduit linings for above project, Spec. 988, to Lynchburg Fdry. Co., Lynchburg, Va., **$96,945.** Bids 9/29. CD 9/10 and 9/19—ENR 9/18.

†**Calif., Camp Callan**—Con. Q.M., concrete drainage flume, West Side, Camp Callan, to W. V. Hutchison, Box 191, Hillcrest St., San Diego, **$24,910.**

Calif., Turlock—Directors Turlock Irrigation Dist., concrete canal lining in Dist. 180A, Brendel Ditch, Dist. 235, East Soares Ditch, Dist. 272, west branch, Beaver Ditch, and Dist. 281, DuBois Ditch, to McMillen & Norseen, 427 Mill St. **$25,261.** Bids 10/25. CD 10/15.

Miss., Belzoni—Straight Bayou Drainage & Levee Dist., c/o J. F. Barbour, Jr., Yazoo City, canal clearout 400,000 cu. yd. Straight Drainage and Levee Dist., Humphreys and Sharkey Counties, to L. Smith, Lake Village, at 7c. per cu. yd.; total **$28,000.** Est. $45,000. Bids 10/15, awarded 10/25.

N. J., Cape May—Precast concrete groynes extens. along beach front between Wilmington & Trenton Aves., **WPA. $95,100.** CD 2/7—ENR 2/13.

N. J., East Orange—Grading, rein.-con. floor in 2nd River, **WPA. $68,973.** W. Willegarod, town engr.

★†**New York**—U. S. Eng., 17 Battery Pl., New York, 2,832,500 cu. yd. place measurement materials except ledge rock from Liberty Island Anchorage, to Great Lakes Dredge & Dock Co., 17 Battery Pl., New York, **$1,271,226.** Bids 10/6. CD 10/8—ENR 10/16.

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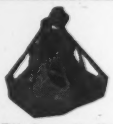

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EARTHWORK, etc. (Contracts Awarded, Cont'd.)

O., Cleveland—F. Foy, city purch. agt., bulkhead for Edgewater Park Yacht Basin, to Great Lakes Dredge & Dock Co., Williamson Bldg., $204,925. J. M. Heffelfinger, 518 City Hall, engr.

O., Cleveland—Grasselli Chemical Co., c/o Mr. Newcomb, engr. Independence Rd., concrete piling work, to L. A. Wells Constr. Co., 1122 Schofield Bldg., Est. $25,000.

★**†Pennsylvania**—U. S. Eng., 332 Post Office Bldg., Baltimore, Md., Solomon Creek pump station, flood control project, incl. pump, levee, storage reservoir, etc., Hanover Twp., Luzerne Co., to Sordoni Constr. Co., Forty Fort. $579,353. CD 10/8—ENR 10/16.

Tex., Houston — Harris Co. Flood Control Auth., c/o R. R. Lewis, Houston, straightening Buffalo Bayou, ditching, dredging, etc. WPA. Approx. $200,000. H. W. Zapp, Court House, engr.

UNCLASSIFIED

PROPOSED WORK

★**†Ariz., Hillside**—CONCENTRATOR — Bagdad Copper Corp., Hillside, concentrator capable treating 2,500 tons copper ore daily. $2,500,000. Defense Plant Corp. will finance.

Ark., Ft. Smith—HANGAR—C. Holland, mayor, hangar, airport. $50,000.

Ark., Little Rock—HANGAR, etc.—C. E. Mayer, mayor, hangar and office bldg., Adams Field (municipal airport). $135,000.

Calif., Alameda—WHARF—Pacific Bridge Co., 333 Kearny St., San Francisco, 38x525 ft. timber outfitting wharf, foot of Stanford St.

Calif., Long Beach—LIGHTING SYSTEM—Ornamental lighting sys., Pacific Coast Hy. $150,000. G. E. Baker, City Hall, engr.

Calif., Newport Beach—BEACH IMPROVEMENTS—Beach imprvs., steel or timber piling. $156,000-$198,000. R. L. Patterson, City Hall, engr.

Calif., Newport Beach—PIER, etc.—G. Watson, 4253 Sierra Way, San Bernardino, pier and mooring float, appurtenances, to extend 30 ft. into Rivo Alto, Canal sect., west portion Newport Bay.

Calif., Richmond—SHIPBUILDING PLANT STORAGE FACILITES—Todd-California Shipbuilding Corp., Richmond, storage facilities for shipbuilding plant. Over $40,000.

Colo., Estes Park — RECREATIONAL IMPROVEMENTS—Recreational imprvs. Stanley Memorial Park, grading, filling to race track, polo field, rodeo grounds, roads, parking, etc. $80,000.

†Ill., Marion — PARK and CAMP — Farm Security Admin., The Mall between 12 and 14 Sts. S.W., Wash., D. C., park and camp for trailers for defense workers.

Ia., Waterloo — PARKING AREA — K. Matthews, city clk., parking area, downtown dist. $175,000 incl. cost of land.

†Mass., Salem—SEAPLANE RAMP—Coast Guard Div., Treas. Dpt., 14 and D Sts. S.W., Wash., D. C., rejected bids Sept. 22, seaplane ramp, Coast Guard Air Station. CD 10/9—ENR 10/16 under LB.

Minnesota—RURAL ELECTRIC LINES—Renville-Sibley Co-operative Power Assn., Fairfax, E. Schmechel, supt., 136 mi. rural electric transmission lines, Renville and Sibley Counties. $115,000. Ellerbe & Co., E. 1021 1st Natl. Bank, St. Paul, engr. CD 10/17—ENR 10/23.

Missouri—RURAL ELECTRIC LINES—Sho-Me Power Co-operative, c/o R. A. Dinwiddie, Columbia, and G. Stockard, atty., Jefferson City, rural electric sys. in vicinity Denver, Milan, Butler, Des Arc, Monticello, Sedalia, Savannah, Hannibal, Tipton, Steelville, Macon, Watson, Platte City, Lexington, Mexico, Triplett, Licking, Foristell, Vandalia, Linn, Trenton, Lancaster, Fayette, Fulton, West Plains and Columbia. Over $25,000.

Mont., Missoula — AIRPORT RUNWAYS — Exten. runways, airport. $150,000. CAA. WPA funds sought.

Neb., Fremont — AIRPORT — Runways, lighting, drainage, municipal airport. $450,000.

†Neb., Omaha—HANGAR, etc.—War Dpt., 20 St. and Constitution Ave. N.W., Wash., D. C., hangar and 50,000 gal. underground storage tank, municipal airport. $30,000.

N. J., Camden—PARK IMPROVEMENTS—Camden Co. Park Comn., Court House, excavating, athletic fields, drainage, retaining walls, etc., Harleigh Park. $109,623. WPA. G. R. Swinton, 930 Atlantic Ave., Atlantic City, WPA and owner's engr.

N. J., Egg Harbor and Galloway—AIRPORT IMPROVEMENTS — City of Atlantic City, City Hall, Atlantic City, excavating, grading, 2 in. asphalt concrete runways, airport, English Creek and Tilton Rds. $62,500. WPA. G. R. Swinton, 930 Atlantic Ave., Atlantic City, WPA engr.

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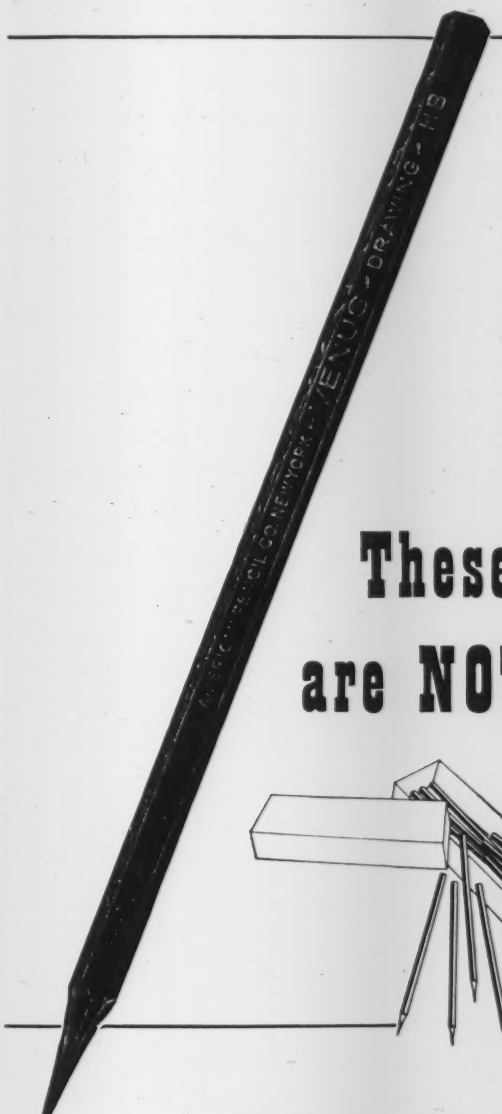

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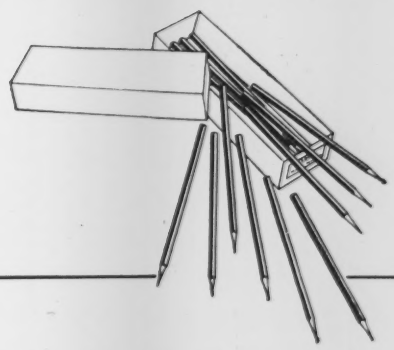

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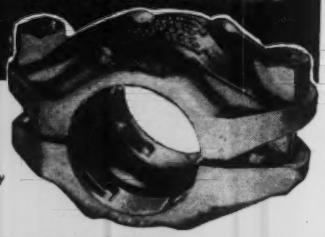

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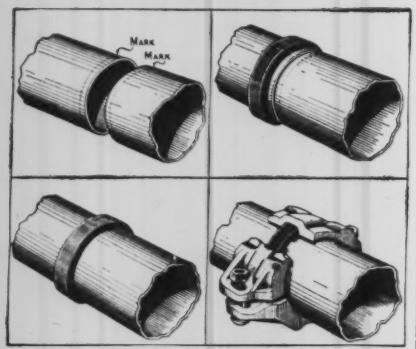

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UNCLASSIFIED (Proposed Work, (Cont'd.)

†**N. J., Fort Monmouth**—LANDSCAPING, etc.—Con. Q.M., landscaping, grading, timber bridge. $57,250. WPA. W. D. Cougle, 1102 S. Broad St., Trenton, WPA and owner's engr.

N. J., Jersey City — MARINE REPAIR YARD—Erie R.R. Co., J. W. Smith, ch. engr., Midland Bldg., Cleveland, O., soon lets contract, marine repair yard, concrete, steel boiler shop, machine shop, mooring racks, etc., 7 W. and Hudson River. $300,000.

†**N. J., Morristown** — PARK IMPROVEMENTS—Dpt. Interior, 19 and C Sts. N.W., Wash., D. C., conserving, protecting natural and historical resources, excavating, grading, draining, landscaping, etc., Morristown Natl. Historical Park. $50,091. WPA. C. Malstrom, Orange and N. 6 Sts., Newark, WPA engr.

N. J., Newark—FREIGHT HOUSES, etc.—Erie R.R. Co., J. W. Smith, ch. engr., Midland Bldg., Cleveland, O., soon lets contract, 1 story, 40x350 ft., brick, steel freight houses and covered platforms, Pacific St.

N. J., New Brunswick — WELL PUMP, etc.—Rutgers University, College Ave., well pump, connections, waterlines, reforestration, fence, etc. $51,669. WPA. J. H. Weitzen, Smith and Hobart Sts., Perth Amboy, WPA engr.

N. Y., Brooklyn—DOCK, etc.—Dpt. Parks, Arsenal Bldg., Central Park, 64 St. and 5 Ave., New York, rowboat dock and boat house, Prospect Park. $120,000.

N. Y., Sardinia—GAS PLANT, etc.—Iroquois Gas Corp., Iroquois Bldg., Buffalo, natural gas distr. plant and sys., pipelines, service connections. $48,000.

Oklahoma — RURAL ELECTRIC LINES — Caddo Electric Co-operative Assn., R. G. Shaw, supt., Binger, indefinitely postponed bids to have been opened Oct. 24, 125 mi. transmission lines, Caddo, Comanche, Grady and Kiowa Counties. C. H. Guernsey, 1216 Grand Ave., Cherokee, engr. CD 10/21.

Ore., LaGrande—AIRPORT GRADING, etc.—Grading, paving, exten. runways, airport. $350,000. CAA.

Pennsylvania—PARK—Dpt. Forests & Waters, G. A. Stewart, secy., Harrisburg, developing 1,000 acre state park, incl. roads, walkways, grading, recreation facilities, etc., Parker Dam. Over $50,000.

†**Pa., Kittanning**—AVIATION GASOLINE STORAGE DEPOT—U. S. Eng., 925 New Federal Bldg., Pittsburgh, aviation gasoline storage depot, 106 acre site, East Franklin Twp., near here.

S. D., Parkston—SWIMMING POOL, etc.—Swimming pool, recreational equip., bath house, fence. $25,000. Perkins & McWayne, 322 Paulton Blk., Sioux Falls, engrs.

★**Utah, Provo**—POWER SYSTEM—M. Harding, mayor, expanding power sys. $860,000. Applied to DPW. E. A. Jacob, city engr.

†**Wash., Everett** — AIRPORT IMPROVEMENTS—U. S. Eng., Central Bldg., Seattle, bids soon paving parking apron, 2 taxi strips, drainage, etc., Paine Field, near here.

Wash., Olympia — AIRPORT RUNWAYS — Exten. runways, airport. $300,000. CAA. C. H. Williams, City Hall, engr.

Wash., Port Angeles — AIRPORT TAXIWAYS — Clallam Co., Courthouse, taxiways, airport. $100,000. CAA. J. Lay, Courthouse, engr.

Wash., Yakima—AIRPORT GRADING, etc.—Grading, paving, exten. runway, airport. $150,000. CAA. A. B. Collins, City Hall, engr. CD 10/21—ENR 10/23.

Que., Chicoutimi — LODGE, etc. — Foundation Co. Ltd., Chicoutimi, lodge, camps, dining hall, etc. $30,000.

Sask., North Battleford—HANGARS, etc.—Dominion Govt., Ottawa, Ont., hangars, etc. $250,000. Dpt. Munitions & Supply, Ottawa, Ont., engrs.

BIDS ASKED

Bids Asked November 17

N. Y., Ballston Spa—RECREATIONAL and ATHLETIC FIELD—Bd. Educ., Union Free School Dist. 1, town of Milton, High School, Malta Ave., Ballston Spa., general grading, water supply and baseball field for recreational and athletic field. S. A. Arnold, 101 Park Ave., New York, N. Y., landscape archt.; adv. ENR 11/6.

Bids Asked November 21

†**R. I., Newport**—CRANE SYSTEM—Pub. Wks. Officer, Naval Training Station, push type beam rail bridge cranes, runways, transfer connections, crossovers, electric hoists, suspension members, rails, electrification details, Bldgs. 14 and 15, Spec. 10668.

Bids Asked November 27

†**California** — FISH HATCHERY — Bureau Reclamation, Old Post Office Bldg., Sacramento, hatchery bldg., Coleman Station, for migratory-fish control, Kenneth Div., Central Valley Project, Spec. 1014.

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UNCLASSIFIED (Bids Asked, Cont'd.)

Bids Asked

†**Me., Bar Harbor**—AIRPORT—U. S. Eng., Park Sq. Bldg., Boston, Mass., airport exten., NE/SW landing strip 500x4,000 ft. widening, exten. N/S landing strip to 500x4,000 ft., paved runway 150 ft. wide, boundary and contact lighting. $295,000.

LOW BIDDERS

Calif., Wilmington—CONDUIT—Los Angeles City Dpt. Water & Power, 207 S. Bway., Los Angeles, 7-duct conduit line between Harbor Steam Plant and R St., Spec. 3976, from Geo. J. Bock Co., 1120 N. Las Palmas St., Los Angeles. **$117,500.**

†**Md., Carderock**—WIND TUNNELS—Yards & Docks, Navy Dpt., 18 St. and Constitution Ave. N.W., Wash., D. C., 2 wind tunnels, U. S. Naval Experimental Model Basin, from The Darby Corp., 1 and Walker Sts., Kansas City, Kan. **$96,884.** CD 10/24.

Miss., Laurel—AIRPORT GRADING, etc.—J. C. Miller, mayor, grading, drainage, etc., airport, from W. G. Cook, Forest. **$300,000.** Est. $325,000.

CONTRACTS AWARDED

†**Ala., Dothan**—FUELING SYSTEM—U. S. Eng., 1 and Douglas Sts. N.W., Wash., D. C., fueling sys., Flying School, to Aqua System Inc., 385 Gerard Ave., New York, N. Y. **$102,800.**

†**Calif., San Diego**—OPERATING BASE—Yards & Docks, Navy Dpt., 18 St. and Constitution Ave. N.W., Wash., D. C., expanding facilities, Naval Operating Base Training Station, Spec. 10564, to J. H. Simpson, 516 S. Raymond Ave., Pasadena. **$132,524.**

Fla., Tampa—RUNWAYS, etc.—U. S. Eng., P. O. Box 4970, Jacksonville, runways, paving, taxiways, etc., airport for Hillsborough Co., to Cone Bros. Constr. Co., Caesar and Walton Sts. **$158,862.**

Ga., Atlanta—AIRPORT—U. S. Eng., Federal Bldg., Mobile, Ala., paving apron, taxiways streets and storage yard, Atlanta Municipal Airport (Candler Field), to R. H. Wright & Son, Macon Rd., Columbus. **$180,933.** Bids 9/30. CD 9/26.

Ill., Chicago—VENTILATING SYSTEM—Dpt. Subways and Superhighways, 20 N. Wacker Dr., Contr. M-3, subway ventilating sys., to Geo. E. Mathis & Co., 5658 S. Western Ave., **$196,690.** Bids 9/11. CD 8/26—ENR 8/28.

★†**La., Lake Charles**—RUNWAYS, TAXIWAYS—U. S. Eng., foot of Prytania St., New Orleans, runways and taxiways, to T. L. James & Co., Inc., Ruston. **$1,301,263.** CD 10/30.

†**N. J., Audubon**—GAS MAINS—Pub. Bldgs. Admin., 7 and D Sts. S.W., Wash., D. C., gas mains, various streets, for defense housing. **WPA. $62,217.** G. R. Swinton, 930 Atlantic Ave., Atlantic City, WPA and owner's engr.

N. J., Bayonne—RECREATION AREA—Recreation area, excavating, landscaping, drainage, walls, etc. **WPA. $62,500.** CD 10/7—ENR 10/9.

N. J., Bordentown—RECREATIONAL FACILITIES—Excavating, grading, landscaping, fields, etc., recreational facilities, Crosswicks St. **WPA. $117,409.** W. D. Cougle, 1102 Broad St., Trenton, WPA engr.

N. J., Bridgeton—ATHLETIC FIELD IMPROVEMENTS—Concrete bleachers, concrete surfaces on 4 tennis courts, imprv. athletic field. **WPA. $70,845.** CD 10/22—ENR 10/30.

N. J., Camden—PARK—Camden Co. Park Comn., Courthouse, excavating, grading, landscaping, athletic fields, etc., various parks. **WPA. $65,500.** G. R. Swinton, 930 Atlantic Ave., Atlantic City, WPA and owner's engr. CD 4/22—ENR 4/24.

N. J., Egg Harbor and **Galloway**—AIRPORT—City of Atlantic City, City Hall, grading, 24,200 sq. yd. 4½ in. asphalt concrete runway, airport. **WPA. $58,500.** G. R. Swinton, 930 Atlantic Ave., Atlantic City, WPA engr.

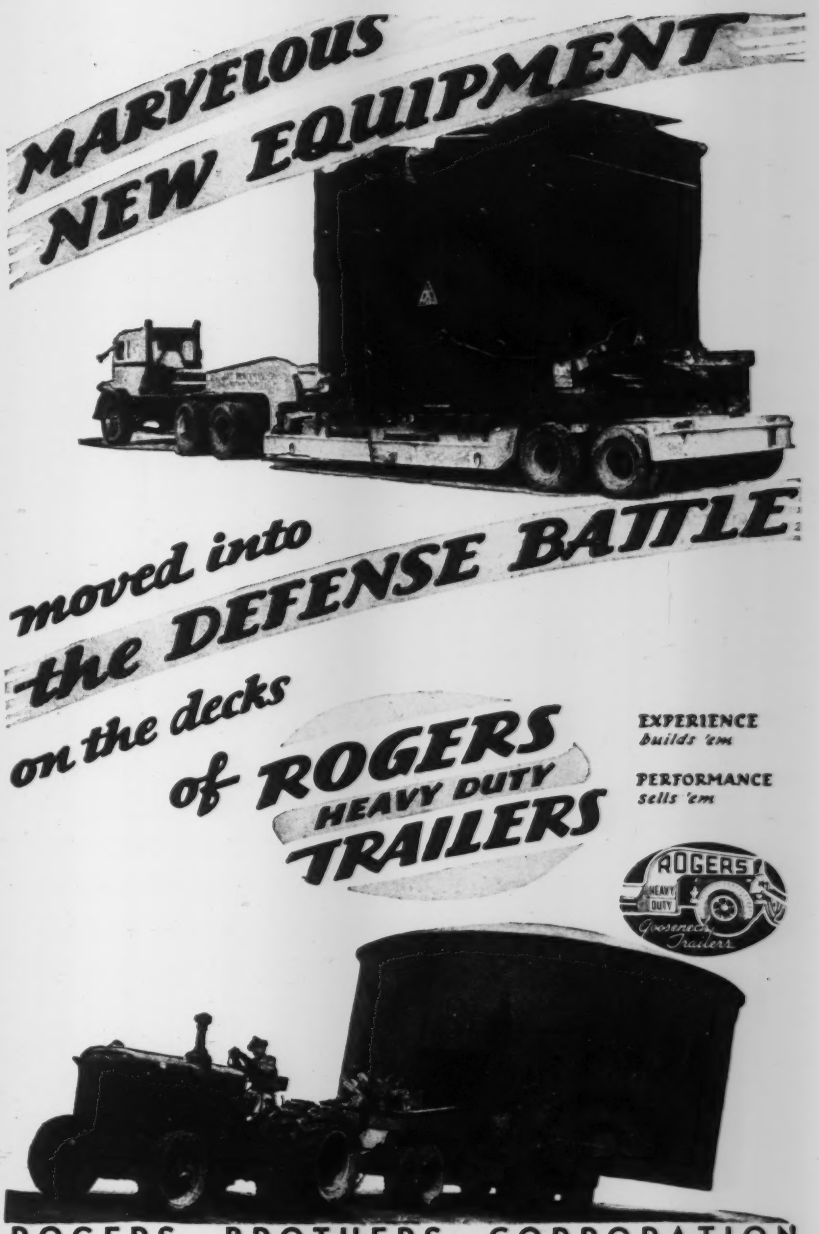
†**N. J., Fort Dix**—FORT IMPROVEMENTS—War Dpt., 20 St. and Consfitution Ave. N.W., Wash., D. C., fort imprvs., reconstructing bridges, removing old railroads, utilities, etc., **WPA, $56,000.** W. D. Cougle, 1102 S. Broad St., Trenton WPA and owner's engr. CD 9/23—ENR 9/25.

†**N. J., Fort Dix**—RAILROADS—Con. Q.M., 5 mi. standard gage railroads, etc., **WPA. $60,326.** W. D. Cougle, 1102 S. Broad St., Trenton, owner's and WPA engr. CD 10/21—ENR 10/23.

N. J., Fort Monmouth—RAILROAD—Con. Q.M., 7 mi. main line railroad and 2 mi. sidings, etc., **WPA, $50.374.** W. D. Cougle, 1102 S. Broad St., Trenton, WPA and owner's engr. CD 10/21—ENR 10/23.

N. J., Newark—PARK IMPROVEMENTS—Essex Co. Park Comn., 115 Clifton Ave., imprv. parks, excavating, sheeting, 4,050 ft. 12 in. vitr. tile sewers, 2 in. water line, etc., **WPA. $70,000.** R. D. Crater, 115 Clifton Ave., co. engr.

N. J., Newark—UNDERGROUND DUCTS—Fire Dpt., City Hall, excavating, underground ducts for fire alarm sys. in 43 streets. **WPA. $51,567.** C. Malstrom, Orange and N. 6 Sts., Newark, WPA engr.



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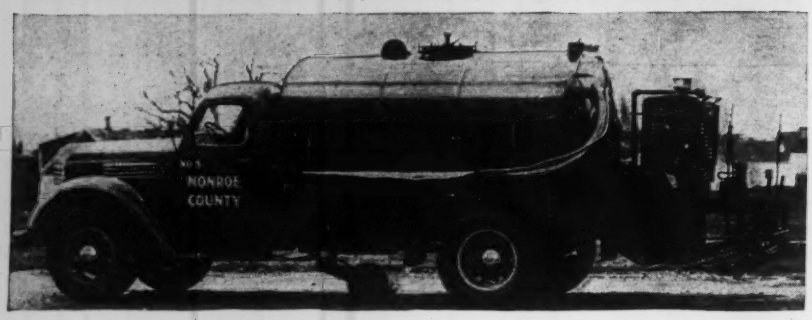

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UNCLASSIFIED (Contracts Awarded)

†**N. J., Salem**—PIER—War Dpt., Constitution Ave. N.W., Wash., D. C., ing pier with new piling, decking. Mott, **WPA. $107,869.** G. R. Sw Atlantic Ave., Atlantic City, WPA engr. CD 10/23—ENR 10/30.

★**N. Y., Russell**—MINE DEVELOPMENT—Clifton Ore Co., Inc., Leader Bldg., land, O., mine development, to Wo Co., 208 S. La Salle St., Chicago. **$1,500,000.** CD 8/25—ENR 8/28.

O., Cleveland—DOCK—Baltimore R. R. Co., C. W. Van Horn, v. p., Ambassador Apt., Baltimore, Md., replac pile dock with steel concrete pilin Cuyahoga River, to L. A. Wells Co 1123 Schofield Bldg. Est. **$50,000.**

Okla., Tulsa—AIRPORT—U. S. E Wright Bldg., completing landing field Tulsa Municipal Airport 1, to Standard Paving Co., 2119 E. 11 St. **$263,532.** CAA

Pa., Warren—GATHERING PIPELINES—United Refining Co., Box 780, Warren, gathering pipelines sys. various Warren County oil pools to connect with owner's oil refinery, Glade Run, east of here, own forces. $25,000.

†**R. I., Quonset Point**—NAVAL STATION IMPROVEMENTS—Con. Q.M., timber crib pier, roads, etc., Hope Island, Naval Air Station, Spec. 10620, to Centaur Constr. Co., Inc., 11 W. 42 St., New York, N. Y., **$137,285.** CD 10/27—ENR 10/30 under LB.

†**Tex., Garland**—RAILWAY, etc.—Gulberson Diesel Engine Co., 1000 Forest Ave., Dallas, spur railway trackage, right-of-way, etc. for engine plant, to E. L. Martin, 4954 Cass St., Dallas, **$32,000.** J. Gordon Turnbull Co., c/o owner, ch. engr.

Utah, Salt Lake City—AIRPORT IMPROVEMENTS—U. S. Eng., Los Angeles, Calif., street imprvs., Salt Lake City Military Airport, to W. E. Ryberg Co., 1259 E. S. Temple St., and Mullins & Wheeler, 22½ E. 1 St., $42,964. Bids 9/26.

Wis., Manitowoc — PARKS — Imprv. parks. **WPA. $90,000.**

Man., Souris—HANGARS—Dpt. National Defense for Air, Ottawa, Ont., 2 hangars, S. F. T. School 44, to Bird Constr. Co., Ltd., 708 Confederation Life Bldg., Winnipeg, about $25,000. Bids 10/16. CD 10/14—ENR 5/15.

Que., Levis—WHARF—Dominion Govt., Ottawa, Ont., 800 ft. deep water wharf, to P. H. Murphy, Lauzon, Est. **$300,000.** Dpt. Transport, Ottawa, Ont., engrs.

PUBLIC BUILDINGS

PROPOSED WORK

†**Ala., Birmingham**—City Bd. Educ., Ramsay Technical High School addn., Docket Ala. 1-113. $135,000. **DPW.**

†**Ala., Gadsden**—City, elementary and junior high school, Docket Ala. 1-107. $100,000. **DPW.** CD 7/29—ENR 7/31.

†**Calif., Escondido**—Escondido Union Elementary School Dist. of San Diego Co., school, Docket Calif. 4-149. $37,674. **DPW.**

★†**Calif., Inglewood**—North American Aviation, Inc., Inglewood, increased manufacturing facilities, incl. bldgs. and equip., for War Dpt. $954,099. Defense Plant Corp. will finance. CD 8/15—ENR 8/21.

Calif., Richmond—Richmond Elementary School Dist., sketches completed by Dragon & Schmidts, 2068 Allston Way, Berkeley, Lincoln School. $160,000.

Colo., Denver—School Dist. 1, plans by W. G. Jamieson and R. E. Stiffler, 813 12 St., Opportunity School, 13 and Welton Sts. $200,000. Applied to DPW.

†**Colo., Denver**—School Dist. 1, in City and Denver Co., plans by Gordon D. White, 615 Columbine St., school, Docket Colo. 5-101. $189,000. **DPW.** CD 10/16—ENR 10/23.

†**Conn., Bantam** — Defense Housing Div., FWA, 811 Vermont Ave. N.W., Wash., D. C., 40 defense housing units.

†**Conn., Bridgeport**—City, Bd. Educ., plans by Toby Vece, 1241 Main St., brick, steel Edson School addn., Docket Conn. 6-108, Harvey St. and Boston Ave. $100,000. **DPW.** CD 10/24—ENR 10/30.

†**Conn., Stratford**—Town, plans by Frederick H. Beckwith, 19 P. O. Arcade, Bridgeport, Stony Brook School addns., Docket 6-128 $135,000, Lordship School addns., Docket Conn. 6-145 $70,479; plans by C. Wellington Walker, 1115 Main St., Bridgeport, Franklin High School addn., Docket Conn. 6-135, $55,437. **DPW.** CD 10/28—ENR 10/30.

†**Fla., Niceville**—Bd. Pub. Instruction for Okaloosa Co., acting for special tax School Dist. 6, school, Docket Fla. 8-158. $50,000. **DPW.**

†**Fla., Sebring**—City, municipally owned power plant and distr. sys., extens., addn., Docket Fla. 8-124. $132,710. **DPW.**

†**Ga., Atlanta**—Atlanta Housing Auth., 180 housing units, for USHA.

PUBLIC BLDGS. (Proposed Work, Cont'd.)

†Ga., **Camp Stewart**—Con. Q.M. plans by ★Tucker & Howell, Inc., 1711 Rhodes-Haverty Bldg., Atlanta, army bldgs. $3,500,000.

Ill., Chicago—Comrs. Cook Co., plans by ★E. E. Hall, 123 W. Madison St., 3 story maternity hospital, near 1800 W. Harrison St. About $750,000. CD 2/11—ENR 2/20.

†**Ill., Joliet**—Assn. of Franciscan Sisters of the Sacred Heart, for St. Joseph's Hospital addn., Docket Ill. 11-179. $125,000. **DPW.**

†**Ill., Rock Island**—School Directors, Dist. 35, Rock Island Co., temporary school, Docket Ill. 11-151. $30,000. **DPW.**

Ill., Salem—Bd. Educ., high school. Over ★$500,000.

Ind., Jeffersonville—Comrs. Clark Co., for Clark County Memorial Hospital addn., Docket Ind. 12-126. $190,000. **DPW.**

†**Ky., Muldraugh**—Bd. Educ. Meade Co., school, Docket Ky. 15-133. $19,625. **DPW.**

†**Me., Kittery**—Town plans by Wells, Hudson & Granger, Main St., Hanover, N. H., 2 story, bsmnt., brick, steel school, Docket Me. 17-105. $347,960. **DPW.** CD 9/4—ENR 9/11.

†**Md., Elkton**—Defense Housing Div., FWA, 811 Vermont Ave. N.W., Wash., D. C., 500 defense housing units.

†**Mass., Newton**—Zenith Products Co., 58 Chestnut St., brick, steel factory, Monantum Dist. Over $40,000. Defense Plant Corp. will finance.

†**Mass., Watertown**—Con. Q.M., Army Base, Boston, plans by J. R. Worcester & Co., 79 Milk St., Boston, 3 story, bsmnt., 90x93 ft., brick, steel laboratory, Watertown Arsenal. $250,000.

†**Mich., Saginaw**—Saginaw General Hospital, hospital wing Docket Mich. 20-125. $268,062. **DPW.**

†**Mich., Walled Lake**—Walled Lake Consolidated Schools, Dist. 1 Fractional, Commerce Twp., school addn., Docket Mich. 20-136. $46,000. **DPW.**

Minn., Columbia Heights (br. Minneapolis)—Bd. Educ., A. H. Ittner, clk., 948 41 Ave. N.E., Minneapolis, plans by Toltz, King & Day, 1509 Pioneer Bldg., St. Paul, 2 story, bsmnt., rein.-con., stone school addn. $180,000.

Miss., Grenada—$50,000 bond election Nov. 7, enlarging mill.

†**Mo., Clayton (St. Louis P. O.)**—City School Dist., school, Docket Mo. 23-156. $23,000. **DPW.**

★†**Mo., Clayton (St. Louis P. O.)**—St. Louis Co., 6 story health center, County Hospital grounds, Docket Mo. 23-139. $522,500. **DPW.** CD 8/11—ENR 8/14.

N. J., Camden—State, Quartermaster Gen'l Dpt., State House, Trenton, brick, steel National Guard Armory bldg.

N. J., Chatham—Bd. Educ., Town Hall, rejected bids Sept. 17, 2 story, part bsmnt., 80x124 ft. and 24x34 ft., brick, limestone school, Elm Pl. Project abandoned. F. A. Elsasser, 1000 Stuyvesant Ave., Union, archt. Runyon & Carey, 33 Fulton St., Newark, engrs. CD 8/29—ENR 9/4.

N. Y., Brooklyn—Dpt. Hospitals, 125 Worth St., New York, kitchen bldg., Kings County Hospital. $450,000.

N. Y., Brooklyn—President Brooklyn Boro, Boro Hall, garage near Hamilton Ave. yard, incl. site. $300,000.

N. Y., Flushing—Bd. Higher Educ., 695 Park Ave., New York, boiler house, alterations, addns., Queens College. $149,500.

†**N. Y., Greenport**—Div. Defense Housing, FWA, 811 Vermont Ave. N.W., Wash., D. C., 50 prefabricated dwelling units, for industrial employees, Project 30023 X.

N. Y., Jamaica—Dpt. P. Wks., Municipal Bldg., New York, Jamaica Health Center and borough office. $450,000.

N. Y., Jamestown—Bd. Pub. Utilities, City Hall, T. V. McKee, secy., brick, steel, concrete sub-station, Harrison St., also transmission line from Steele St. generating plant. $40,000. C. O. Johnson, supt.

★**N. Y., New York**—Bd. Educ., 110 Livingston St., Brooklyn, P.S. 106 addn., St. Raymond Ave. and Odell St., Bronx Boro. $752,400.

★**N. Y., New York**—Dpt. P. Wks., Municipal Bldg., cell bldg. and infirmary, $250,000; kitchen and utility bldg., $495,000, Harts Island Reformatory Prison.

N. Y., New York—Dpt. P. Wks., Municipal Bldg., laundry, Rikers Island Penitentiary. $216,500.

N. Y., New York—Dpt. P. Wks., Municipal Bldg., Lower West Side market. $300,000 incl. site.

★**N. C., Asheboro**—Bd. Comrs. Randolph Co., T. Fletcher Bulla, chn., defeated bonds, schools. $600,000. CD 5/15—ENR 5/22.

†**N. C., Fayetteville**—Cumberland Co., hospital, Docket N.C., 31-138. $400,000. **DPW.**

N. C., Greenville—B. B. Sugg, mayor, voted $250,000 bonds, white and negro schools addns.

†**N. C., Jacksonville**—Onslow Co., hospital, Docket N.C. 31-164. $160,470. **DPW.**

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PUBLIC BLDGS. (Proposed Work, Cont'd.)

N. C., Lenoir—Bd. Comrs. Caldwell Co., G. M. Goforth, chn., bond election soon, school bldgs. $393,100. V. D. Guire, Lenoir, chn. Bd. Educ.

O., Akron—A. E. Kemler, dir. Pub. Serv., plans by Good & Wagner, 1st Central Tower Bldg., 2 story, 200x200 ft. service garage. $100,000. Mayer & Valentine, 2036 E. 22 St., Cleveland, engrs.

★**†O., Canton**—Republic Steel Corp., C. A. Thayer, ch. engr., Republic Bldg., Cleveland, steel plant. $5,140,500. Defense Plant Corp. will finance. CD 6/23—ENR 6/26.

O., Cuyahoga Falls—Bd. Educ., G. Roberts, supt., plans by M. M. Konarski, 1100 Merriman Rd., Akron, 1 and 2 story, 16 classroom school. $225,000. CD 6/2—ENR 6/5.

★**†O., Dayton**—Pub. Bldgs. Admin., 7 and D Sts. S.W., Wash., D. C., 250 defense housing residences. $1,500,000.

†O., Dayton—U. S. Eng., Wright Field, 2 story, brick, steel dynamotor laboratory $150,000, aero medical laboratory bldg., $150,000, both Wright Field.

O., Mt. Sterling—Mt. Sterling Chamber of Commerce, A. Clay, pres., 1 story, brick, tile dress factory. $50,000. C. J. Kiefer & Assoc., E. 6 St., Cincinnati, engrs.

★**†O., Warren**—Copperweld Steel Co., S. D. Williams, vice pres. in charge, 100,000 ton annual capacity ingot steel plant, $4,000,000. Defense Plant Corp. will finance.

†Pa., Aliquippa — School Dist., Aliquippa Boro, school and high school addns., Docket Pa. 36-123. $102,000. **DPW.**

†Pa., Bristol—Fleetwings, Inc., Bristol, additional expansion plant facilities, equip., for manufacture aircraft parts and accessories, for War Dpt. $354,035. Defense Plant Corp. will finance.

Pa., Duquesne — Allegheny Co. Housing Auth., F. L. Palmer, exec. dir., 301 County Office Bldg., Pittsburgh, plans by Smithyman & Braziell, 64 Vandergrift Bldg., Pittsburgh, 180 family unit low cost housing, Project Pa. 6-4, Crawford Hill; 90 family low cost housing development, Project 6-5. $415,000. USHA. J. Fred Triggs, Berger Bldg., Pittsburgh, engr., site plan. E. T. Wiesmann, Thaw Bldg., Pittsburgh, electrical engr. P. A. Edwards, Wabash Bldg., Pittsburgh, heating engr. A. Dzubar, 74 N. Fremont Ave., Pittsburgh, plumbing engr.

†R. I., Newport—Con. Q.M., Army Base, Boston, Mass., converting brick plant into USO recreation bldg. Chas. A. Maguire & Associates, 613 Turks Head Bldg., Providence, R. I., engrs.

★**†S. C., Columbia**—Richland Co., hospital for negroes, hospital addns., alterations for whites and negroes, home for negro nurses, altering boiler house. Docket S.C. 38-115. $894,000. **DPW.** CD 10/9—ENR 10/16.

†S. C., Spartanburg—Spartanburg Co., remodeling old bldg., constructing 4 story addn. Spartanburg General Hospital, Docket S.C. 38-156. $402,570. **DPW.**

†Tenn., Jackson—Madison Co., school, Docket Tenn. 40-115. $150,000. **DPW.** CD 8/21—ENR 10/28.

†Tex., Abilene—City, Jr. High School, temporary addns. Alta Vista, Locust and Negro Schools, Docket Tex. 41-142. $301,000. **DPW.** CD 7/29—ENR 7/31.

Tex., Beaumont—French School Dist., c/o R. W. Gary, supt., plans by Steinman & Coleman, Box 3267, Beaumont, 1 story, 73x272 ft., brick school and gymnasium. $150,000. Applied for DPW funds.

Tex., Brownwood — Brownwood Housing Auth., Brownwood, bids soon, 300 unit housing. $350,000. USHA. Phelps & De Wees and Simmons, Majestic Bldg., A. B. and R. M. Ayres, Smith-Young Tower, all San Antonio, archts. J. W. Beretta Engineers, Natl. Bank of Commerce Bldg., Matthews & Kenan, 1615 Smith-Young Tower, F. E. Simpson, 1445 Milam Bldg., H. R. Helland, 503 Frost Bldg., all San Antonio, engrs. CD 8/12—ENR 8/14.

★**Tex., Corpus Christi**—City, A. C. McCaughan, mayor, and Nueces Co., c/o Judge, Corpus Christi, bond election Nov. 18, 5 story hospital, 4 story nurses home, 5 story tuberculosis bldg., 2 story utility bldg. Total cost $1,500,000. Applied for DPW gr. Brock, Roberts & Anderson, c/o Jones Bldg., archts. Matthews & Kenan, c/o Smith Young Tower Bldg., San Antonio, engrs. CD 10/14—ENR 10/16.

Tex., Corpus Christi—Corpus Christi Ind. School Dist., plans by Brock, Roberts & Anderson, 1012 Jones Bldg., and Hedrick & Fox, 1205 Nixon Bldg., Robert Driscoll Junior-High School. $200,000. Applied for DPW funds. CD 4/30—ENR 5/15.

Tex., Cushing—Bd. Educ., 1 story, brick, native rock, concrete school. $150,000.

†Tex., El Paso—Myra Winkler Common School Dist. W-21, Myra Winkler School addn. Docket Tex. 41-153. $56,750. **DPW.**

†Tex., Fort Worth — Tarrant Co., public health center, Docket Tex. 41-259. $57,300. **DPW.**

†Tex., Garland — Gulberson Di... Co., 1000 Forest St., Dallas, mech... water, sewer, gas, electric lines... tioning, etc., for plant, for War Dp... Defense Plant Corp. will finance... Turnbull Co., c/o owner, engr.

Tex., Lufkin—Angelina Co., c/o ... soon, courthouse annex. $150,000... Coston, Lufkin, archts.

†Tex., Robstown—City, J. C. Kell... health center, Tex. 41-354. $43,6... Hamon & Co., Jones Bldg., Corp... archts. CD 9/15—ENR 9/18.

†Tex., Texarkana—Federal Securi... 901 Maverick Bldg., San Antonio, ... and recreation bldg., facilities, Te... $71,150. **DPW.**

★**†Utah, Marysville** and **Lehi** — ... Inc., c/o Olin Co., Inc., East A... alumina plants, Marysville and Leh... $2,000,000. Defense Plant Corp., wil...

†Utah, Ogden—Ogden Bd. Educ., ... L. S. Hodgson, Eccles Bldg., ... gymnasium, Central Jr. High School... Utah 42-103. $173,000. **DPW.** CD ... ENR 10/30.

★**†Wash., Tacoma**—Olin Corp., East Alton, Ill., addnl. aluminum plant facilities, for War Dpt. $600,000. Defense Plant Corp. will finance. Additional to CD 9/12—ENR 9/18.

†W. Va., Morgantown—Bd. Educ., Monongalia Co., altering, imprv., repairing, remodeling 16 school bldgs., Docket 46-116. $62,225. **DPW.**

★**†Wis., Beloit** — Fairbanks-Morse Co., Beloit, 460x660 ft., brick, steel factory for Navy Dpt. $5,500,000 incl. equip. Cunningham Bros., Beloit, engrs. CD 10/28—ENR 10/30.

★**†Wis., Merrimack** — Hercules Powder Co., Delaware Trust Bldg., Wilmington, Del., army ordnance plant. $65,000,000.

†Alaska, Ketchikan—City, 2 story health center bldg., Docket Alaska 50-112. $40,000. **DPW.**

Alta., Medicine Hat—Generating plant exten. $275,000. H. O. Davis, City Hall, engr.

Ont., Windsor—Wartime Housing, Ltd., 55 York St., Toronto, plans by D. J. Cameron, Bartlett Bldg., staff block. $350,000.

Que., Quebec City—Dominion Govt., Ottawa, Ont., depot for Royal Canadian Ordnance Corps. $200,000 Dpt. National Defense, Ottawa, Ont., archts.

★**Que., Quebec City**—Wartime Housing, Ltd., 55 York St., Toronto, Ont., plans by Beagle & Morissette, 21 d'Aiguillon St., 26 single dwellings. $500,000. Deferred until 1942.

BIDS ASKED

Bids Asked November 12

†Ga., Savannah—U. S. Eng., P. O. Bldg., post headquarters bldg., motor repair shop and oil storage house, Savannah Air Base. CD 6/30—ENR 7/3.

Bids Asked November 13

†Ill., Proving Ground—Con. Q.M., Savanna Ordnance Depot, administration bldg.; adv. ENR 11/6.

†Me., Bath—City, Supt. Schools, City Hall, high school addns., alterations, Docket Me. 17-102. **DPW;** adv. ENR 11/6. CD 9/4—ENR 9/11.

Bids Asked November 14

†Md., Aberdeen Proving Ground—Con Q.M., assembly shop. Bids Oct. 15 rejected. CD 10/17—ENR 10/23 under Aberdeen.

N. S., Halifax—Secy. Dpt. Munitions & Supplies, Ottawa, Ont., workshop, dockyard, for Dominion Govt., Ottawa, Ont. $200,000. Dpt. Naval Affairs, Ottawa, Ont., archts. Dpt. Munition & Supply, Ottawa, Ont., engr.

Bids Asked November 17

†Tex., Mineral Wells—J. C. Miller, mayor, municipal bldg., health center, Tex. 41-178. $175,455. **DPW.** P. M. Geren, 806½ Burnett St., Ft. Worth, archt. CD 10/8—ENR 10/16.

Bids Asked November 18

Calif., Los Angeles—Housing Auth., 1250 Western Pacific Bldg., 1031 S. Bway., 100 unit, Rose Hill Courts housing, Mercury and Boundary Aves. $300,000. W. F. Ruckard, 940 S. Figueroa St., and C. Beelman, 1019 Union Bank Bldg., archts. Blake E. Beatty, 816 W. 5 St., engr. CD 8/28—ENR 9/4.

Bids Asked November 20

†Pa., Middletown—U. S. Eng., 332 Post Office Bldg., Baltimore, Md., 29x120 ft. administration bldg., utilities, Middletown Air Depot, Olmsted Field; adv. ENR 11/6.

Bids Asked November 24

†California—Bureau Reclamation, Old Post Office Bldg., Sacramento, cold storage plant, Coleman Station, for migratory fish control Kenneth Div., Central Valley Project, Spec. 1585-D.

Wash., Tacoma—Furnishing, installing one 55,000 hp. hydraulic turbine, one 40,000 kw. electric generator for LaGrande Powerhouse; two 34,500 hp. hydraulic turbines, two 25,000 kw. electric generators for Alder Powerhouse. CD 10/17—ENR 10/23.

PUBLIC BLDGS. (Bids Asked, Cont'd.)

Bids Asked December 1

★†**Tex., Waco**—U. S. Eng., Federal Bldg., Galveston, bldgs., utilities, streets, roads, etc., for Basic Flying School, 6 mi. northeast of here. Tentative date. $4,000,000-$5,000,000. CD 8/22—ENR 8/28.

LOW BIDDERS

†**Calif., Long Beach** — U. S. Eng., 751 S. Figueroa St., Los Angeles, Oct. 27, temporary bldgs., Long Beach A. C. Ferrying Command, Inv. 509-42-96, from R. D. Merrill Constr. Co., Helena, Mont. **$438,181.** CD 10/21.

★†**Mass., Springfield**—Con. Q. M., Springfield Armory, Oct. 28, 1st story, 120x280 ft., 2nd and 3rd story, 80x280 ft., brick, steel, rein.-con., stone gun stock plant addn., from E. J. Pinney Co., Inc., 220 Dwight St., **$533,000.** J. R. Worcester & Co., 79 Milk St., Boston, engrs. CD 10/14—ENR 10/16.

N. J., Burlington—Burlington Housing Auth., general contract, 90 dwelling units, N. J.—20-1, for USHA, from Karno-Smith Co., Inc., Broad St. Bank Bldg., Trenton. **$261,700***** structural steel and iron, from Arrow Iron Works, 408 Whiton St., Jersey City. **$12,196***** plumbing, from Nicholas Connelly, Inc., 1404 N. 18th St., Phila., Pa., **$56,665***** heating, from Triangle Ventilating Co., 1719 Meadow St., Brooklyn, N. Y., **$22,5000***** electrical work, from P. G. Peifer, Harbourton. **$9,878.** CD 10/7—ENR 10/9.

†**Pa., East Rochester**—Beaver County Housing Auth., 119-9 St., Monaca, Oct. 27, 75 defense housing units, Project 36057 X, for USHA, from G. H. Chilli, 1st Natl. Bank Bldg., Homestead, **$342,500.** CD 10/21—ENR 10/23.

†**Pa., Pulaski** — Beaver County Housing Auth., Monaca, Oct. 27, 100 defense housing units, Pulaski Twp., Project 36055 X, for USHA, from G. H. Chilli, 1st Natl. Bank Bldg., Homestead, **$457,500.** CD 10/21—ENR 10/23.

†**Wash., Fort Lewis**—Con. Q.M., Oct. 28, barracks, miscellaneous housing, Fourth Echelon Base, Inv. 6105-42-27, from Macdonald Bldg. Co., 1517 South Tacoma Way, Tacoma. **$222,000.**

CONTRACTS AWARDED

★†**Ala., Mobile**—U. S. Eng., Federal Bldg., superstructure ocean terminal, Brookley Field, to United Constr. Co., Winona, Minn. **$1,130,753.** CD 10/17—ENR 10/23.

★†**Calif., Long Beach**—Div. Defense Housing, FWA, 1206 Santee St., Los Angeles, 600 defense housing units, Los Angeles Harbor area, State St. and Santa Fe Ave., to Zoss Constr. Co., 1037 Cole Ave., Los Angeles, **$1,412,420;** site development, sewers, water, gas, etc., to Myers Bros., 3407 San Fernando Rd., Los Angeles. **$304,733.** CD 10/22—ENR 10/30.

★†**Calif., Santa Monica** — Douglas Aircraft Corp., 3000 Ocean Park Blvd., 230x300 ft. freight warehouse, 24x2400 ft. storage shed, 30x100 ft. office bldg., on Pacific Electric Airline track near Cloverfield, for War Dpt., to Alco Constr. Co., 5423 Flemish Village Lane, Los Angeles, approx. **$500,000.** Bids 9/12. CD 9/10.

★†**La., New Orleans**—Yards & Docks, Navy Dpt., 18 St. and Constitution Ave. N.W., Wash., D. C., receiving station and radio station facilities, Naval Station, NOY 5085, to Geo. J. Glover Co., Inc., 1430 Whitney Blvd., **$824,000** cost plus fixed fee.

†**Maryland**—U. S. Eng., 1 and Douglas Sts. N.W., Wash., D. C., storage warehouse for office, Chief of Engineers, at Dalecarlia Reservation, adjacent to Dist. Columbia Line, Montgomery Co., to Lee T. Turner, 1366 Perry Pl. N.W., Wash., D. C., **$32,370.** Bids 10/8. CD 9/30—ENR 10/2.

†**Mass., Boston**—Yards & Docks, Navy Dpt., 18 St. and Constitution Ave. N.W., Wash., D. C., 5 story, brick, steel bldg., Charlestown Navy Yard, to Thomas O'Connor & Co., 238 Main St., Cambridge. **$634,000.**

†**Mich., Battle Creek** and **Augusta** — Con. Q.M., 20 North Wacker Dr., Chicago, Ill., USO recreation bldgs., Battle Creek and Augusta, to Miller-Davis Co., 1917 Factory St., Kalamazoo. **$172,500. DPW.** CD 9/22—ENR 9/25.

★†**N. J., Clifton**—Pub. Bldgs. Admin., 9 and D Sts., S. W., Wash., D. C., one hundred fifty 1 and 2 story defense housing, Project 28092 X, to James Mitchell, Inc., 575 West Side Ave., Jersey City. **$631,000.**

N. Y., Manhasset—Town, School Bd., grade and high school addns., to Andrew Weston Co., 7 E. 42 St., New York. **$258,000.** Bids 10/20. CD 9/26—ENR 10/2.

O., Galion—Power piping, municipal electric plant, to B. Shorn Co., Wilmington, Del. **$57,000.** W. C. Kammerer, 1900 Euclid Bldg., Cleveland, engr.

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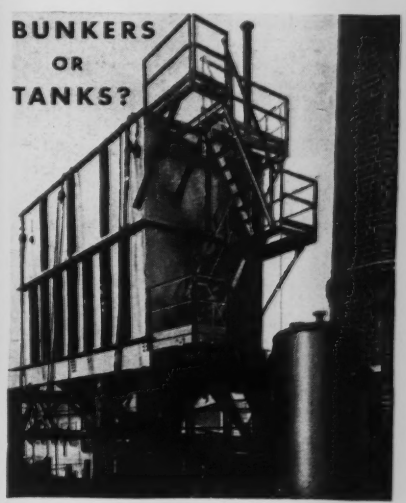

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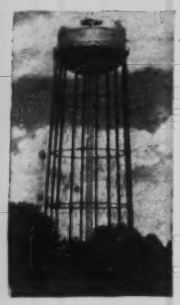

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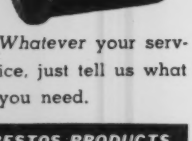

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PUBLIC BLDGS. (Contracts Awarded, Cont'd.)

S. C., Columbia—University of South Carolina, J. Rion McKissick, pres., Naval Armory for ROTC, 2 connecting bldgs., 2 story drill hall, 3 story classrooom. **WPA. $150,000.** Hopkins & Baker, Florence, archts.

Ont., Petawawa—Dpt. National Defense, Ottawa, twelve 1 story, 30x100 ft. bldgs. for storage magazine Military Camp, to M. Sullivan & Son, Ltd., Arnprior. $100,000.

COMMERCIAL BUILDINGS

PROPOSED WORK

Md., Baltimore—M. A. Mace, 2170 N. Glebe Rd., Arlington, Va., 500 two story, brick, frame dwellings.

★**Md., Baltimore**—Frank Novak Realty Co., Erdman Ave., 2,000 2 story, bsmnt., brick row houses, Brehms Lane and Register Ave. $6,000,000.

Mont., Helena — Intermountain Theatre Corp., c/o W. F. Owens, archt., Sheridan, Wyo., theatre. $200,000.

N. J., Kenilworth—Harding Manor, Michigan Ave., plans by Schmidlin & McMurray, 982 Stuyvesant Ave., Union, 1½ story, bsmnt., 55 frame homes, 12 St. $302,500.

★**N. J., Lodi**—Parkside Homes, Inc., 234-44 St., New York, N. Y., one hundred fifty, 1½ story, bsmnt., 24 x 28 ft., brick, frame homes, Ave. E. $750,000.

★**N. J., Madison**—M. C. Eng. Co., Woodland Rd., 100 homes, Madison Acres, Woodland Rd. $1,200,000.

N. J., Pompton Plains—C. S. Orben, 786 Broad St., Newark, thirty 2 story, bsmnt. homes, Pompton Plains Manor. $150,000.

N. J., South Plainfield—D. G. Contg. Corp., 505-5 Ave., New York, N. Y., plans by W. S. Moore, 122 E. 42 St., New York, N. Y., 50 one story wood siding homes. $200,000.

N. Y., Dunkirk—Brooks Memorial Hospital, Central Ave., plans by W. A. Cannon, Main St., Niagara Falls, hospital. $190,000.

N. Y., Forest Hills—S. Lefrak, 44 Court St., Brooklyn, plans by M. Hirsch, 44 Court St., Brooklyn, 6 story apartment, 65-14 Saunders St. $150,000.

N. Y., New York—Mt. Sinai Hospital, 11 E. 101 St., plans by R. D. Kohn & C. Butler, 56 W. 45 St., altering 3 bldgs., 11 E. 101 St. $150,000.

N. Y., Norwood—W. E. Gracey, Norwood, plans by A. Kieff, Chamber of Commerce Bldg., Watertown, residential construction. Over $150,000.

O., Cleveland — Seventh Day Adventist Church, G. R. Carter, pastor, 15227 Hilliard Rd., plans by H. W. Maurer, 3120 Scarboro Rd., Cleveland Heights, stone, steel, concrete church. $150,000.

O., Springfield — Bd. Trustees, Wittenberg College, Dr. R. E. Tuloss, pres., campaign to raise funds under way, for library addn. $200,000.

Pa., York—J. C. Hoffman, Hillcroft, York, 22 dwellings, 30 acre site, Hillcroft Village sector. $150,000.

★**R. I., Newport**—Narragansett Housing Co., MacAuley Apartments, plans by G. Iser, 109 E. 29 St., New York, N. Y., and takes bids in December, 162 unit, brick housing development. $500,000. Albro & Cronin, 38 Chauncy St., Boston, Mass., assoc. archts. (**Correction**—Architect's address.) CD 10/10—ENR 10/16.

Tex., Dallas—Sears, Roebuck & Co., 1409 S. Lamar St., store. $150,000.

★**Tex., Harlingen**—Valley Baptist Hospital, c/o Elizabeth B. Henderson, mgr., Harlingen, plans by H. K. Smith, Highland Park Shop Village, Dallas, 3 story, brick, cast stone, hollow tile hospital. $502,800. Applied for DPW funds. F. S. Robertson, San Benito, consult. engr.

Tex., Houston—A. W. Estes, Park Pl., plans by H. C. Caldwell, South Standard Life Bldg., brick, tile, concrete commercial bldg. $150,000.

Tex., Velasco—J. G. Long, Bay City, plans by E. L. Shult, 5009 Fannin St., Houston, 1 story, mezzanine, 50x124 ft. theatre.

★**Va., Alexandria**—Metropolitan Life Insurance Co., 1 Madison Ave., New York, N. Y., preliminary plans housing on 160 acre site, Beverly Hills sect. $27,000,000.

Va., Radford—Radford Community Hospital, Inc., J. L. Kirkwood, in chg., plans by F. F. Stone, archt and engr., 110½ W. Church Ave., Roanoke, hospital. $260,000.

BIDS ASKED

Bids Asked After October 31

Tex., Houston—Second Presbyterian Church, 2714 Main St., 2 story, brick, concrete recreational, educational and service bldg. $200,000. W. A. McElroy & H. Lloyd, Esperson Bldg., archts.

Bids Asked December 1

Ind., Anderson—St. John Hospital, part 5 and 6 story hospital wing, for Sisters of the Holy Cross, 2001 Jackson St. $300,000. Schmidt, Garden & Erickson, 104 S. Michigan Ave., Chicago, Ill., archts.

Bids Asked January

Tex., Houston—Masonic Bldg. Assn., Houston, 919½ Main St., 3 [illegible] bsmnt. 100x125 ft. masonic bldg. $230,000. [illegible] 500 Stuart St., archt. T. R. Allens State Bank Bldg., assoc. [illegible]

Bids Asked

★**Calif., Long Beach**—Alamitos [illegible] 639 S. Spring St., Los Angeles, list bidders), 419 single detached [illegible] wood frame, stucco, steel, east [illegible] wood Blvd. $1,000,000. E. P. [illegible] S. Palm Dr., Beverly Hills, [illegible] Sargent, 1725 Silver Lake Blvd., Los Angeles, engr.

O., Cincinnati—J. C. Penney Co., 330 W. 34 St., New York, N. Y., alterations, remodeling 6 story bldg., 6 and Race Sts. $200,000.

O., Oberlin—Oberlin College Board of Trustees, E. H. Wilkens, pres. (invited bids) 3 story, 86x210 ft., brick, steel, concrete [illegible] $250,000. E. J. Schulte, 920 E. McMillan St., Cincinnati, archt. J. P. Jones, Cass & Miller Terminal Tower, Cleveland, O., engr. CD 6/26—ENR 6/26, under BA.

R. I., Kingston—Cedarhurst Farms, Inc., Quonset Point, (selected list bidders) 25 single homes, 6 apartment bldgs., residential development, North Kingston. $150,000. A. B. Mills, 1822 First St. N.W., Wash., D. C., archt.

CONTRACTS AWARDED

Calif., Bellflower—W. S. McCray, 5507 Ashworth St., 104 wood frame, stucco dwellings, Amos and Autry Sts. Owner builds. $335,000. W. L. Moody, 614 Architects Bldg., Los Angeles, archt.

Calif., Long Beach—Ideal Home Builders, 215 W. 7 St., Los Angeles, 50 five room dwellings, frame, stucco, Baltic and Canal Sts. Owner builds. **$150,000.**

★**Ill., Chicago**—Illinois Institute of Technology, 3300 S. Federal St., College Bldgs., State and Dearborn Sts., 31 to 34 Sts., to R. Wieboldt Co., 1412 W. Washington Blvd. Est. **$3,000,000.** CD 2/4—ENR 2/6.

Ill., Chicago—Owner, c/o General Contractor, forty 2 story 6 room brick houses, Christiana Ave., to P. Brenard, 4440 S. Christiana Ave. Est. **$200,000.**

Ill., Elmhurst—Schless Constr. Co., 176 W. Adams St., Chicago, 3 story, 78x117 ft. apartment, 16 car garage. Owner builds. **$150,000.** R. Salisbury, 130 W. Liberty St., Wheaton, archt.

Mass., Pittsfield—St. Mary's R. C. Church, J. C. McMahon, pastor, church, foundation contract, to Lindholm Constr. Co., Inc., 127 East St. Total est. **$300,000.** CD 10/14—ENR 10/16.

N. Y., Brooklyn—Williamsburgh Savings Bank, 1 Hanson Pl., altering, exten. 3 story bank, to John E. Warner & Sons, Inc., 722 Evergreen Ave. Est. **$150,000.** CD 9/22—ENR 9/25.

N. Y., Forest Hills—One Hundred and Thirteenth Street Corp., 29-28 41 Ave., Long Island City, 6 story apartment, 72-61 113 St., separate contracts. **$400,000.** P. Birnbaum, 303 W. 42 St., New York, archt. CD 10/22—ENR 10/30.

★**N. Y., Hamburg**—S. Tomaka, 29 Myrtle Ave., Lackawanna, residences. Owner builds. Over **$500,000.** G. M. Gale, 8-16 St., Buffalo, archt.

N. Y., Queens Village—Arbor Oaks, Inc., Union Turnpike and 217 St., Hollis, 24 homes, 82 Ave., 217 and 218 Sts. Owner builds. **$175,800.** H. W. Johanson, 62-52 61 St., Rockwood, archt.

N. Y., Tonawanda—MacBain & Sons, Inc., Colvin Ave., Buffalo, residences. Owner builds. **$150,000.**

N. Y., Utica—Stanwix Development Corp., 203 Park Ave., residences, to Kay Constr. Co., 203 Park Ave. Est. **$450,000.** S. Pennock, 2719 Genesee St., archt.

N. C., Charlotte—American Trust Co., W. H. Wood, pres., bldg. addn., W. 4 St., to Southeastern Constr. Co. Est. **$250,000-$275,000.**

O., Dayton—Ohio Bell Telephone Co., 42 E. Gay St., Columbus, A. G. Thingulstad in chg., Melrose exchange dial office bldg., to G. F. Weber & Co., Commercial Bldg. Est. **$315,000** incl. equip. Schenck & Williams, 3rd Natl. Bank Bldg., archt.

O., Columbus—Bob Byers, Inc., 815 Nelson Rd., 50 homes various sections city, to William Van Cleve, 815 Nelson Rd. **$257,750.** Awarded 10/23. W. T. Mills, 152 S. Garfield St., archt.

O., South Euclid (br. Cleveland)—Ohio Bell Telephone Co., A. W. Bailey, in charge, 750 Huron Rd., Cleveland, 1 story, bsmnt., 85x88 ft., brick, stone, concrete telephone exchange, to Hebing Co., 1832 W. 54 St., Cleveland. Est. **$150,000.** Bids 10/14. CD 10/14—ENR 10/16.

INDUSTRIAL BUILDINGS

PROPOSED WORK

Conn., Bridgeport—FREIGHT TERMINAL—New England Transportation Co., 63 College St., New Haven, plans by J. and D. Ebers, 2 W. 47 St., New York, N. Y., brick, steel, freight terminal, Connecticut Ave. at Wilmot St. $40,000. CD 10/16—ENR 10/23.

INDUSTRIAL BLDGS. (Proposed Work, Cont'd.)

★**Ill., Franklin Park**—FACTORY—Continental Can Co., 4633 W. Grand Ave., Chicago, 1 and 2 story, 400x1,000 ft. factory, 25 St. and Grand Ave. $1,500,000.

Ind., Whiting — REFINERY — Standard Oil Co. of Indiana, 910 S. Michigan Ave., Chicago, Ill., 3 story, 60x150 ft., brick refinery. $100,000.

Md., Baltimore—SHOP, etc.—Bethlehem Steel Co. Shipbuilding Div., 1101 Key Highway, shop building and 2 piers, Key Highway.

★**Minnesota** — ELECTRIC GENERATING PLANTS, etc.—Western Minnesota Power Co-operative, C. R. Hove, secy., Alexandria, electric generating plants, western Minnesota, to supply power to rural distr. sys. 4 to be built this year, 1 at Alexandria, and 1 at Benson, other sites not announced. $220,000-$225,000 ea. $1,500,000 REA allot. General Eng. Corp., 2944 Cedar Ave., Minneapolis, engrs.

Minn., Milaca — PLANT — Land O'Lakes Creameries, L. L. Getten, production mgr., 2201 Kennedy St. N.E., Minneapolis, plans by M. Buetow, 1931 University Ave., St. Paul, 1 or 2 story, milk dehydration plant, brick, tile. $150,000.

Minn., Benson — GENERATING PLANT — Stevens-Big Stone Co-operative, Power Assn., Benson, preliminary plans generating plant. REA. General Eng. Corp., 2944 Cedar Ave., Minneapolis, engrs.

N. J., Holland — POWER PLANT — N. J. Power & Light Co., 38 Main St., Flemington, brick, steel power plant addn. E. M. Gilbert Eng. Corp., 412 Washington St., Reading, Pa., engr.

N. J., Kearny—STORAGE SHED—Federal Shipbuilding & Drydock Co., Lincoln Hy., soon lets contract 1 story, 100x400 ft. frame, metal siding storage shed, Ship Yards on Lincoln Hy.

N. Y., Brooklyn—FACTORY—Vulcan Proofing Co., 5622-28 First Ave., plans by William Higginson & Sons, 101 Park Ave., New York, altering 2 story factory, 5622-28 First Ave. $50,000.

N. Y., Rochester — FACTORY — Staynew Filter Corp., 25 Leighton Ave., 170x250 ft. factory. $175,000. S. Firestone, 59 South Ave., engr.

★**N. Y., Rochester**—FOUNDRY—Symington Gould Corp., Symington Pl., plans by Kaelber & Waasdorp, 311 Alexander St., foundry. $500,000.

N. Y., Rochester—PLANT—Haloid Co., 6 Haloid St., 40x250 ft. plant addn. $45,000. S. Firestone, 59 South Ave., engr.

N. Y., Walton—PLANT—Breakstone Bros., A. I. Luscomb, genl. mgr., Walton, rebuilding milk, dairy and cheese products mfg. plant. Over $40,000.

O., Akron—PLANT—C. M. Wilkinson Co., 619 E. Tallmadge Ave., addnl. factory unit adjoining present plant, also office bldg. $50,000.

O., Cleveland—FACTORY — Radiart Corp., L. K. Wildberg, pres., 3571 W. 62 St., factory addns., alterations, W. 63 and Denison Sts. $75,000.

O., Lorain—PLANT—G. L. Roth, et al, Franklin, Pa., reconditioning, addn., etc., former Brunk Mache. & Forging plant. Over $50,000.

Pa., Danville — PLANT — American Swedo Iron Corp., Danville, rehabilitation, addns., imprvs. iron and steel plant. Over $40,000.

Tex., Livingston — PLANT — Corrington & Livingston Farm Exchanges, c/o T. Drew, Livingston, cheese processing plant. $40,000.

Wis., Oshkosh—FACTORY—Wisconsin Axle Corp., factory addn. Over $40,000.

Alta., Edmonton—OIL REFINERY—Bolton & Gallagher, Edmonton, oil refinery exten. $50,000.

Alta., Kaleland—GRAIN ELEVATOR — Alberta Pacific Grain Co. Ltd., Kaleland, grain elevator. $40,000.

B. C., Steveston—CANNERY—B. C. Packers, Ltd., 7 Campbell St., Vancouver, cannery exten. $44,000.

B. C., Vancouver — ELEVATOR — Alberta Wheat Pool, Ltd., 7 Cassiar St., elevator. $50,000. C. D. Howe Co., Ltd., P. U. Bldg., Port Arthur, Ont., engrs.

B. C., Vancouver—MILL—Chatham Point Logging Co., Ltd., 553 Granville St., saw and shingle mill. $40,000.

B. C., Victoria—PLANT—British American Paint Co. Ltd., 14 Belleville St., plant exten. $40,000.

B. C., Victoria—PLANT—Victoria Glass & Woodworks Ltd., 2518 Turner St., manufacturing plant. $40,000.

N. B., Saint John—PLANT—New System Laundry & Cleaners, Ltd., 30 Lansdowne Ave., plant exten. $45,000.

N. S., Halifax—PLANT—W. Stairs, Son & Morrow Ltd., 7 Lower Water St., plant exten. $55,000.

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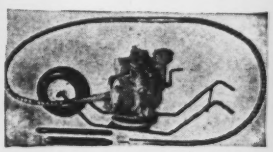
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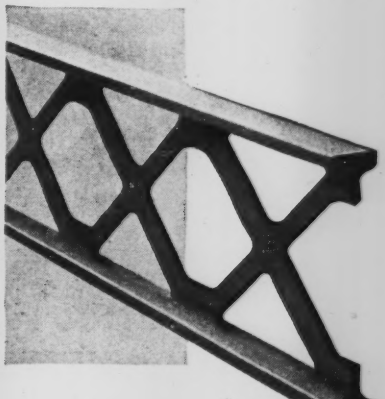

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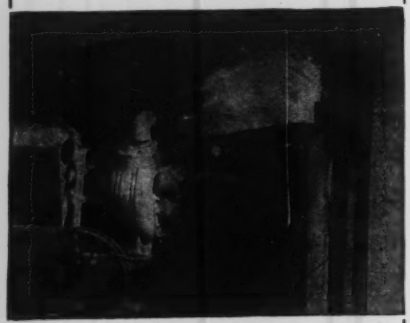

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INDUSTRIAL BLDGS. (Proposed Work, Cont'd.)

Ont., Cooksville—PLANT—Hand Fireworks Co. Ltd., Cooksville, plans by Hanks & Irwin, 2890 W. Bloor St., Toronto, frame, stucco plant exten., concrete fdn. $50,000. CD 12/30—ENR 1/2.

Ont., Cornwall — BAKERY — Wonder Bakeries, Ltd., 323 Prince Albert St., Montreal, Que., bakery and confectionery plant. $50,000. Architect, c/o E. Charbonneau, 602 York St.

Ont., Hamilton—PLANT—Canadian Drawn Steel Co. Ltd., Garrard St., bids soon, plant exten. $200,000.

Ont., Hamilton — PLANT — National Steel Car Co., Kenilworth Ave., plans by Hutton & Souter, 36 James St. S., 100x310 ft. and 50x310 ft. brick, tile, steel bldgs. $400,000.

Ont., Kingston—SERVICE STATION—Cities Service Co., Ltd., 28 Cataragui St., service station, Bath Rd. $35,000.

Ont., Kitchener—FACTORY—Vetter Shoes, Ltd., Kitchener, factory. $40,000.

Ont., Leaside—FACTORY—Stucco Products Ltd., 199 Alexandria Blvd., Toronto, factory. $40,000.

Ont., London—PLANT—Coleman Packing Co., D. Bieman, owner and mgr., 7 First St., 4 story, brick, rein.-con. plant addn. $45,000-$50,000. J. C. Klaehn, King St., Kitchener, engr. CD 1/20—ENR 1/23.

Ont., London — PLANT — A. H. McPhail, archt., Canada Bldg., Windsor, rejected bids plant, for Daisy Dale Candies, Ltd., 641 Tecumseh Blvd., Windsor. Est. $40,000. Will readvertise. CD 9/18—ENR 9/25.

Ont., Merritton — MILL — Alliance Paper Mills, 407 McGill St., Montreal, Que., 40x80x40 ft., rein.-con. sulphite mill addn. $50,000. J. C. Day, 630 W. Dorchester St., Montreal, Que., engr.

Ont., Port Arthur—GRAIN ELEVATOR—Sask Pool Terminals Ltd., Public Utilities Bldg., grain elevator exten. $50,000.

Ont., Port Hope — PLANT — Mathews Conveyor Co. Ltd., Port Hope, plant exten. $40,000.

Ont., Preston—PLANT—Clare Bros. Ltd., 216 King St., remodeling plant. $40,000.

Ont., Toronto—MACHINE REPAIR SHOP, etc.—Dufferin Paving & Crushed Stone, Ltd., 14 Fleet St. W., machine repair shop, garages, etc. $50,000.

Ont., Toronto—PLANT—Government of Poland, c/o General V. Podoski, Consul-General, Ottawa, airplane assembling plant. $200,000.

Ont., Toronto—PLANT—Swift Canadian Co. Ltd., 7 St. Clair Ave. W., plans by Arthur, Fleury & Piersol, 9 Elm St., plant exten. $40,000.

Ont., Woodstock—FACTORY—E. E. Paquette & Sons, Ltd., Woodstock, factory. $50,000.

Que., Chicoutimi — ABBATTOIR — Agricultural Society, Inc., Chicoutimi, abbattoir. $40,000. Architect, c/o E. Maltais, St. Jean Baptiste Range, Chicoutimi.

Que., Farnham—PLANT—J. M. Robertson, engr., 1396 St. Catherine St. W., Montreal, rejected bids plant exten., for Collins & Aikman Corp., 51 St. and Parkside Ave., Phila., Pa. $50,000. CD 8/21—ENR 8/28.

Que., Giffard—FACTORY—Pony Brand Essence & Syrup Co., Ltd., 14 Industrial St., plans by Rousseau & Begin, 1 Ferland St., Quebec City, 36x87 ft. and 36x104 ft. brick factory, concrete fdn. $40,000.

Que., Montreal—PLANT—H. Smith Paper Mills, Ltd., 407 McGill St., Lybster plant alterations, addns. $150,000. J. C. Day, 630 W. Dorchester St., engr.

Que., Mount Royal (P. O. Dist. Montreal)—FACTORY—Canadian Cerium Co., Ltd., 455 Craig St. W., Montreal, plans by J. J. Kugel, 4382 Oxford Ave., Montreal, 1 story, bsmnt., 73 x 140 ft., rein.-con., brick factory. $40,000. CD 9/17—ENR 10/2, under Montreal.

Que., St. Croix—MILL—South Shore Industries, Ltd., St. Croix, c/o E. Laflamme, mill. $40,000.

Que., Three Rivers—PLANT—Bourassa & Bro., 1538 Champlain St., 200x1,000 ft. aerated manufacturing and bottling plant.

Que., Ville St. Pierre—PLANT—Consumers Glass Co. Ltd., 606 Cathcart St., Montreal, glass products plant expansion. $600,000. C. Kemp, 606 Cathcart St., Montreal, engr.

BIDS ASKED

Bids Asked November 10

Ill., Aurora—POWER PLANT—Sargent & Lundy, engrs., 140 S. Dearborn St., Chicago, superstructures power plant addn., for Western United Gas & Electric Co., 50 Fox St. CD 9/10—ENR 9/18 under CA.

Bids Asked

Conn., Bridgeport — FOUNDRY — Peerless Aluminum Castings Co., 55 Andover St., 1 story, 65 x 144 ft., brick, steel, concrete, monitor type foundry addn., Andrew St. $49,000. P. Petrofsky, 955 Main St., engr. CD 10/23—ENR 10/30.

Mass., Fitchburg—BAKERY [illegible] Water St. (selected list bid [illegible] 85x100 ft., brick bakery. [illegible] Mason, 15 Prospect St., Le[illegible] CD 10/27—ENR 10/30.

Mass., Worcester—SHOP—A[illegible] Wire Co., 94 Grove St., 1 sto[illegible] concrete machine shop addn. [illegible] $40,000.

★**N. H., Laconia**—PLANT—[illegible] General Motors Bldg., D[illegible] manufacturing plant, for Scott [illegible] Inc., Union St., Laconia. $600,000.

N. J., Paterson—GARAGE—[illegible] Buick Co., 969 Market St., plans by [illegible] Newman, 173 Main St., Hacken[illegible] 75x160 ft., cinder block, stucco, [illegible] Lakeview Ave.

O., Warren—FACTORY—American Welding & Mfg. Co., 1 story, 40x340 ft., brick, steel factory. $60,000. W. W. Leipnet, 1900 Euclid Ave., Cleveland, engr.

Pa., Pittsburgh—MANUFACTURING—S. L. Roush, archt., 1210 Chamber of Commerce Bldg., 3 story, 100x100 ft., brick, steel, concrete manufacturing bldg., 2500 Penn Ave., for Kerotest Mfg. Co., E. G. Mueller, pres., 2525 Penn Ave. $100,000. Extended bids. CD 10/21—ENR 10/23.

LOW BIDDERS

Ont., Humberstone—PLANT — Robin Hood Mills, 306 St. Sacrament St., Montreal, Que., plant addn., from Carter-Halls-Aldinger Co. Ltd., 419 Cherry St., Toronto. Est. $100,000. C. D. Howe Co. Ltd., P. U. Bldg., Port Arthur, engrs.

CONTRACTS AWARDED

Calif., Alameda—SHOP—Pacific Bridge Co., 333 Kearny St., San Francisco, 1 story machine shop, 1 story pipe shop, day labor, **$44,000.**

Calif., Los Angeles—PLANT—U. S. Rubber Co., 5675 Anaheim-Telegraph Rd., 3 buildings for manufacturer self-sealing gas tanks for aircraft, incl. 40 x 70 ft., processing bldg., 40 x 60 ft. tank testing bldg., 261 x 840 ft. main bldg., steel frame, rein.-con., near here to Engineers, Ltd., 605 W. Olympic Blvd., approx. **$410,000.** L. A. Parker, 501 Architects Bldg., archt. and engr.

Calif., San Francisco—STORAGE—Calif. Pacific Title & Trust Co., 48 Montgomery St., wood frame storage bldg., to G. Wagner, 161 S. Park St. **$45,678.**

Calif., San Francisco—WAREHOUSE—M. D. Gopevic, c/o N. Maran, 41 Sutter St., warehouse addns., to J. A. Tassi, 2426 Buchanan St., **$42,000.** W. Adrian, 417 Market St., engr.

Calif., Torrance—PLANT—National Supply Co., 1524 Border Ave., plant addn., to Pozzo Constr. Co., 2403 Riverside Dr., Los Angeles; structural steel, miscellaneous metal, to Pacific Iron & Steel Co., 11633 S. Alameda St. Est. over **$40,000.** CD 10/16—ENR 10/23.

Ill., Chicago—FACTORY—A. Epstein, engr., 2001 W. Pershing Rd., 2 story, 55x175 ft. candy factory addn., for Fannie May Candy Shops, Inc., 220 W. Madison St., to Carl E. Erickson & Co., 4753 Bway. Est. **$50,000.** CD 10/8—ENR 10/16.

Ill., Chicago—FACTORY—Illinois Gear Co., 2108 N. Natchez Ave., 1 story, 120x150 ft. factory addn., to Abell & Howe, 53 W. Jackson Blvd. Est. **$55,000.**

Ill., Melrose Park—PLANT—Dean Milk Products Co., 20 N. Wacker Dr., Chicago, 1 story, 120x200 ft. dairy products plant, to Patterson & Hartrich, 105 W. Adams St., Chicago, Est. **$75,000.** L. E. Russell, c/o General Contractor, archt.

Ill., Rochelle—FACTORY—Whitcomb Locomotive Co., 80 E. Jackson St., Chicago, 1 story factory addn., to E. L. Hallbauer Constr. Co., 452 W. Belden Ave., Chicago. Est. **$50,000.** M. L. Pereira, 100 W. Monroe St., Chicago, archt.

Ia., Des Moines—PLANT, etc.—Sargent & Co., 411 E. Grand Ave., plant and office bldg., to Fane F. Vawter, 202 Old Colony Bldg. **$118,839.** CD 10/1.

★**Md., Baltimore**—WAREHOUSE—A & P Food Stores, lessee, 420 Lexington Ave., New York, N. Y., warehouse, to Turner Constr. Co., 420 Lexington Ave., New York, N. Y. Est. **$700,000.**

Md., Baltimore—WAREHOUSE, etc.—Texas Co., 400 Asiatic Ave., warehouse, storage, office bldg. and garage, to W. E. Bickerton Co., 515 Cathedral St. **$75,000.** CD 10/2—ENR 10/9.

Md., Baltimore—DAIRY PLANT—Western Maryland-Fairfield Dairy, Linden Ave. and Dolphin St., 2 story, 40x90 ft., brick, concrete dairy addn., to Consolidated Eng. Co., 20 E. Franklin St. **$40,000.**

INDUSTRIAL BLDGS. (Contracts Awarded, Cont'd.)

Minn., Warroad—PLANT—Border Counties Power Co-operative, Inc., Warroad, T. D. MacKenzie, supt., engines for generating plant, to Buckeye Mchy. Co., Lima, O., **$95,526**; switchgear, to L. A. Kepp Contg. Co., 1421 3 Ave. NW., Rochester, **$12,855.** CD 8/7—ENR 8/14.

Mo., St. Louis—FACTORY—American Thermometer Co., 2917 Clark Ave., 1 story, 137x143 ft., brick, concrete factory, 205 S. Ewing Ave., to William H. & Nelson Cunliff Co., 3320 Lindell Blvd. Est. **$40,000** with equip. G. Neff, 3320 Lindell Blvd., archt.

N. J., Plainfield—FACTORY—Walter Scott & Co., 525 South Ave., design and construction 1 story, 79x104 ft., brick, steel erection bldg. addn., to Wigton-Abbott Corp., 1225 South Ave. **$50,000.**

N. Y., Buffalo—PLANT — Buffalo Niagara Electric Corp., Electric Bldg., plant bldg., to Siegfried Constr. Co., 6 N. Pearl St. Est. over **$40,000.**

N. Y., Buffalo—PLANT—Hanna Furnace Corp., (Div. Natl. Steel Corp.), Fuhrmann Blvd., plant addns. Owner builds. Over **$100,000.**

N. Y., Niagara Falls—PLANT—R. & H. Chemicals Div., E. I. duPont de Nemours, Inc., du Pont Bldg., Wilmington, Del., 50x175 ft. plant, to Laur & Mack Contg. Co., Inc., College Ave. Est. **$40,000.**

N. Y., Rochester — PLANT — Consolidated Machine Tool Corp., Blossom Rd., 1 story, 88x157 ft. plant addn., to A. Friederich & Sons Co., 710 Lake Ave. Est. **$50,000.** J. F. Ancone, 311 Alexander St., engr.

N. Y., Rome — MARKET — M. Rossi, 116 Railroad Ave., market, to Salt City Constr. Co., 411 Seitz Bldg., Syracuse. Est. **$40,000.** CD 10/31/40—ENR 11/7/40.

O., Cleveland — SHOP — Jordon Welding & Mfg. Co., S. W. Jordon, secy., 9428 Cassius Ave., 1 story, 40x120 ft. and 40x90 ft., brick, steel forge and welding shop, to H. I. Dolin, 9916 South Blvd. Est. **$40,000.**

Okla., Tulsa—LABORATORY—Stanolind Oil & Gas Co., Philcade Bldg., 1 story, 50x70 ft., 36x80 ft. and 36x100 ft., monolithic concrete, glass brick wall geophysical and production laboratory addns., concrete fdns., 1136 N. Lewis Ave., to Waller-Wells Constr. Co., 2423 E. 13 Pl. **$121,641.** P. Lorenz, c/o owner, engr.

Tex., Houston—TRAIN SHEDS, etc.—Continental Can Co., 105 N. Greenwood St., exten. train sheds and tracks, to Austin Co., 2nd Natl. Bank Bldg., approx. **$40,000.**

Wis., Milwaukee—FACTORY, etc.—Trackson Co., 3333 S. Chase Ave., 1 story, 71x75 ft., steel, brick factory and office bldg., to Selzer-Ornst Co., 6222 W. State St. Est. **$40,000.** Buemming & Jahn, 925 N. Jackson St., archts.

Ont., Guelph—PLANT—Callander Fdry. & Mfg. Co., Ltd., 7 Crimeau St., 90 x 118 ft., rein.-con., brick exten., to W. Parker, 26 Glasgow St. Est. **$40,000.**

Ont., Hamilton—PLANT—J. Duff & Sons, Ltd., 14 Brant St., meat packing plant, to Frid Constr. Co. Ltd., Terminal Bldg.* Est. **$40,000.**

Ont., Long Branch—PLANT—Small Arms, Ltd., Lake Shore Rd., plant addn., to Foundation Co. of Ontario, Ltd., 1138 Bay St., Toronto. About **$300,000.** CD 10/17—ENR 10/23.

Ont., Merritton — SULPHITE MILL — H. Smith Paper Mills, Ltd., 407 McGill St., Montreal, Que., 20x33 ft. and 20x50 ft. rein.-con. sulphite mill addn., to Redfern Constr. Co. Ltd., 36 Toronto St., Toronto. About **$125,000.** J. C. Day, 630 W. Dorchester St., Montreal, Que., engr.

★ **Ont., Peterboro**—PLANT—Canadian General Electric Co. Ltd., Park St., plant to A. W. Robertson, Ltd., 57 Bloor St. W., Toronto. About **$500,000.** J. M. Lyle, 230 Bloor St. W., Toronto, archt.

Ont., Toronto—FACTORY, etc.—J. C. Eno Canada Ltd., 296 W. Richmond St., factory exten., warehouse addn., to E. S. Martin, 16 Saulter St. Est. **$40,000.** M. Brown, 622 Confederation Bldg., archt.

Ont., Toronto — PLANT — John-Inglis Co. Ltd., 14-24 Strachan Ave., boiler plant and heat-treat bldg., to A. W. Robertson, Ltd., 57 Bloor St. W. About **$100,000.** Allward & Gouinlock, 57 Bloor St. W., archts.

Que., Hull—FACTORY—Holden, Ltd., 147 Albert St., Ottawa, Ont., 3 story, 52x110 ft., structural steel, brick factory addn., concrete fdn., to E. Brunet & Son, 35 Aylmer St. Est. **$50,000.** Richards & Abra, 55 Metcalfe St., Ottawa, Ont., archts.

Que., Longueil — ENGINE TEST HOUSE, etc.—Canadian Pratt & Whitney Co. Ltd., Lorne Ave., engine test house and office bldg., etc., Lorne Ave., to Sutherland Constr. Co. Ltd., 1440 St. Catherine St. W., Montreal. **$70,000.** CD 5/5—ENR 5/15.

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